THE

# JOURNAL OF GAS LIGHTING,

## WATER SUPPLY, & SANITARY IMPROVEMENT.

VOL. VIII. Nº 162—11th YEAR.] LONDON, JANUARY 4, 1859. [Subscription per Ann. { 15s. in Advance / 18s Credit } Price 8d. Unstamped.

CANNEL COAL.

**RAMSAY'S NEWCASTLE CANNEL** was discovered by the Advertiser in 1818. Cannel Coal was then little used in London: after surmounting much opposition, it has become the principal Cannel Coal used in the Metropolis, and has greatly assisted in improving the London gas. Its joint products of gas of high illuminating power, and coke of good quality, make it one of the most economical coals known. It is used by all the London Gas Companies, as well as by many Provincial and Foreign. The Crystal Palace was lighted from it in 1851, and the Post-office, Bank, and *Times* Office, are at present.

FIRE-CLAY RETORTS.

FIRE-BRICKS of all descriptions. Manufactory established in 1804.

RAMSAY'S GARESFIELD COAL and COKE.

Bone and Artificial Manures of all kinds.

Address G. H. RAMSAY, Offices, Broad-chare, Newcastle-on-Tyne.

April 27, 1854.

TO IRONFOUNDERS AND OTHERS.

**WANTED immediately, Tenders for** CAST-IRON PIPES, BENDS, BRANCHES, SYPHONS, &c., for the Geelong Gas Company, Victoria, Australia.

Specifications to be seen at the Office of Mr. J. SCOLTOCK, Inspecting Engineer, 75, Old Broad Street, City, LONDON, and at the Company's Agents, Messrs. JOHN WARRACK and Co., LEITH, with whom Tenders must be lodged on or before the 20th of January, 1859.

**THREE Dry-Lime Purifiers, 5 feet** long, 2 feet 6 inches wide, and 2 feet 6 inches deep, complete without Valves, for SALE at the Gas-Works, Mitcham, SURREY (between Croydon and Wimbledon).

Apply to the MANAGER on the Works.

FOREMAN OF GAS-WORKS.

**WANTED, a person to take the** MANAGEMENT of a small country Work, working three to eight retorts. He will be required to stoke, lay on services, attend to complaints, and, generally assisted by a boy at night, do the whole work of the place, and must be accustomed to the use of Clay Retorts.

Address prepaid, stating wages required, to A. Z., Office JOURNAL OF GAS LIGHTING, 11, Bolt Court, FLEET STREET, E.C.

COWEN'S PATENT FIRE-CLAY RETORTS.

**JOSEPH COWEN and CO.,**
BLAYDON BURN, NEAR NEWCASTLE-ON-TYNE,

Were the only parties to whom a PRIZE MEDAL was awarded at the GREAT EXHIBITION of 1851, for "GAS RETORTS and OTHER OBJECTS in FIRE CLAY."

J. C. and Co. have been for many years the most extensive Manufacturers of Fire-Clay Retorts in the United Kingdom; and orders for Fire-Clay Retorts of all shapes and dimensions, Fire Bricks, and every other article in Fire Clay, are promptly executed at their Works as above.

COWEN'S GARESFIELD COAL AND COKE.
Coal and Coke Office,
QUAY SIDE, NEWCASTLE-ON-TYNE.

**ROBERT MACLAREN and CO.,**
EGLINTON FOUNDRY, GLASGOW,

Manufacturers of all sizes of Cast-Iron Main Pipes, by an improved Patent. General Ironfounders, Gas Engineers, and Wrought-Iron Tube Makers.

FIRST PRIZE IN THE PARIS EXHIBITION.

**JOHN RUSSELL AND CO.,**
THE OLD TUBE WORKS,
CHURCH HILL, WEDNESBURY;
ALMA WORKS,
WALSALL, STAFFORDSHIRE;
and 69, UPPER THAMES STREET, LONDON,

Original Manufacturers of Wrought-Iron Gas Tubes, and Holders of the present Patents; Inventors and First Makers of LAP-WELDED FLUES for Steam Boilers.

J. R. and Co. make all kinds of Tubes and Fittings for Gas, Steam, and Water, and the largest Orders may be executed in a few days.

Gun Metal, and all other kinds of Cocks, Stocks, Dies, and Taps, Galvanised Tubes, &c.

N.B All Goods thoroughly Tested before sent out, and Warranted.

BLAYDON BURN AND LOW BENWELL FIRE-CLAY RETORT AND FIRE-BRICK WORKS, NEAR NEWCASTLE-ON-TYNE.

**WILLIAM COCHRAN CARR begs** most respectfully to thank the Metropolitan, Provincial, and Continental Gas Companies for their patronage for several years past, and to intimate that he has rebuilt and enlarged his extensive premises for the Manufacture of CLAY RETORTS; and that he is now prepared to execute the largest orders with punctuality and despatch. Orders for FIRE-CLAY RETORTS, of all shapes and sizes, FIRE-BRICKS, and all other Articles in Fire-Clay, executed on the shortest notice, and on the most reasonable terms.

London Agents:
JAMES LAWRIE & CO.,
63, OLD BROAD STREET, CITY, LONDON.

**THE GREAT CENTRAL GAS CONSUMERS' COMPANY.**

Just Published,

**A FULL Report of the Proceedings** on the ARBITRATION between A. A. CROLL, Esq., and the GREAT CENTRAL GAS CONSUMERS' COMPANY. Before C. MAY, Esq., C.E., F.R.S., and THOMAS G. BARLOW, Esq., C.E., Arbitrators, and C. HOGGINS, Esq., Q.C., Umpire.

Reprinted from the *Journal of Gas Lighting, Water Supply, and Sanitary Improvement.*

Price 5s., bound in cloth.

A few Copies are on Sale, bound up with the Proceedings before the Parliamentary Committee on the Company's Bill in 1850—price 7s. 6d.

W. B. KING, Office of the "JOURNAL OF GAS LIGHTING," &c., 11, Bolt Court, Fleet Street, LONDON, E.C.

**WILLIAM STEPHENSON & SONS,**
THROCKLEY,
NEWCASTLE-ON-TYNE,
MANUFACTURERS OF EVERY DESCRIPTION OF
FIRE BRICKS, CLAY RETORTS, LUMPS, TILES,
*&c. &c.*

LONDON OFFICES:
76, KING WILLIAM STREET, CITY.

A large stock of Fire-Clay Goods always on hand in London, at the lowest wharf prices, at Messrs. CHRISTIE & Co.'s Wharf, 64, Bankside, SOUTHWARK.

# THE IMPERIAL IRON TUBE COMPANY,

## BIRMINGHAM,

Patentees and Manufacturers of Wrought-Iron Tubes and Fittings

OF EVERY SIZE AND DESCRIPTION FOR

**GAS, STEAM, AND WATER.**

**PATENT GLASS ENAMEL AND GALVANIZED TUBES**

FOR SANATORY PURPOSES.

**PATENT LAP-WELDED IRON TUBES**

FOR

**LOCOMOTIVE, MARINE, AND STATIONARY BOILERS.**

Tubes of all kinds, with or without Flush Joints, for Artesian Wells, and general Boring Stocks, Taps, and Dies, Boiler-Fittings, Brass Cocks, &c.

**The great capabilities of this Company ensure the prompt execution of Orders to any extent for Boiler and Gas Tubes.**

WORKS:—BERKLEY STREET AND GAS STREET,

BIRMINGHAM.

JOURNAL OF GAS LIGHTING NEWSPAPER ONE PENNY

CROSLEY & GOLDSMITH'S

**PATENT SELF-ADJUSTING & COMPENSATING GAS-METERS**

**CANNOT BE OVER OR UNDERCHARGED WITH WATER,**

and they consequently register the quantity of Gas consumed with greater accuracy than Meters in which the Water-Line is variable.

MANUFACTURED BY

**CROSLEY & CO.,**

GAS-METER MANUFACTURERS,

**103, SOUTHWARK BRIDGE ROAD, LONDON.**

N.B. The Patent Self-Adjusting and Compensating Apparatus may be applied to the ordinary Meter.

Manufacturers of LOWE'S PATENT MOTIVE-POWER METER, for situations where there is an inadequacy of pressure to supply the special requirements of certain consumers in low grounds during the day or night.

Also, Manufacturers of EXPERIMENT METERS, GASHOLDERS, GOVERNORS, MINUTE-CLOCKS, PHOTOMETERS, &c. &c., similar to those used by Mr. King, of Liverpool.

## REPORT ON CROSLEY AND GOLDSMITH'S PATENT METERS.

*London, November* 17, 1858.

Having been invited by Mr. William Crosley to examine the performance of the gas-meter recently patented by himself and Mr. Goldsmith, and manufactured by the firm of Crosley and Co., of 103, Southwark Bridge Road, we assembled at their manufactory, and now report the result of our examination.

We did not think it necessary to check the accuracy of the testing gasholder employed, as Mr. Barlow had done this on a prior occasion; and he assured us that he had found the index to agree, foot by foot, with a standard cubic foot measure containing 62·321 lbs. of distilled water, at the temperature of 62° of Fahrenheit and a barometric pressure of 30 inches, being the standard of measure established by law. Our first care, therefore, was to so adjust a 20-light experiment-meter that its registration coincided exactly with the index of the testing gasholder, which meter we subsequently used as the standard testing meter in the experiments hereinafter recorded, taking care from time to time to check its accuracy by the gasholder.

The chief novelty in Messrs. Crosley and Goldsmith's meter consists in an ingenious contrivance for maintaining the water at a uniform level, so that the capacity of the measuring-chamber shall not be affected by a deficiency or by an excess of water. It is well known that the registration of ordinary wet gas-meters, and more especially of the smaller sizes, is liable to considerable variation from this cause; and we consequently selected a 3-light meter for our first series of experiments, and commenced by subjecting it to the severest and most unfair test to which any meter can be put—that is, by adding lights till they commence to burn unsteadily. In this manner, a 3-light meter was tested with 10 lights, with the following results:—

EXPERIMENT *No.* 1.—3-*Light Patent Meter.*

| Number of Lights supplied. | Duration of the Experiment. | Consumption by Test Meter in Feet. | Consumption by Patent Meter in Feet. | Variation per Cent. in Index of Patent Meter. | Rate of Consumption in Feet per Hour. | Friction of the Meter in Tenths of an Inch of Pressure. |
|---|---|---|---|---|---|---|
| 10 | m. s. 30 23 | 25·36 | 25·00 | 1·44 slow | 50·08 | 6·2 |

During the course of this experiment we added 10 cubic inches of water, without producing any appreciable effect upon the registration or upon the steadiness of the lights. We then reduced the number of burners to 3.

EXPERIMENT *No.* 2.—3-*Light Patent Meter.*

| Number of Lights supplied. | Duration of the Experiment. | Consumption by Test Meter in Feet. | Consumption by Patent Meter in Feet. | Variation per Cent. in Index of Patent Meter. | Rate of Consumption in Feet per Hour. | Friction of the Meter in Tenths of an Inch of Pressure. |
|---|---|---|---|---|---|---|
| 3 | h. m. s. 1 13 5 | 19·67 | 20·00 | 1·67 fast | 16·15 | 1·8 |

We continued adding water by 5 cubic inches at a time during this experiment, till 20 cubic inches had been added in all, without flooding the syphon or altering the ratio of difference between the two meters; but with 45 cubic inches of water the syphon became flooded, and the lights were extinguished.

Our next experiment was with 1 light, by which means we obtained the results of experiments with the maximum and with the minimum rate of consumption of which this sized meter is capable.

EXPERIMENT *No.* 3.—3-*Light Patent Meter.*

| Number of Lights supplied. | Duration of the Experiment. | Consumption by Test Meter in Feet. | Consumption by Patent Meter in Feet. | Variation per Cent. in Index of Patent Meter. | Rate of Consumption in Feet per Hour. | Friction of the Meter in Tenths of an Inch of Pressure. |
|---|---|---|---|---|---|---|
| 1 | m. s. 50 0 | 4·91 | 5·00 | 1·83 fast | 5·89 | 1·1 |

The extreme range of variation from absolute truth to which the meter is liable, is therefore between 1·44 per cent. slow and 1·83 per cent. fast, till the surplus-water reservoir is exhausted, when the meter becomes an ordinary one; but when it is borne in mind that this reservoir contains 54 cubic inches of water to compensate for evaporation—that some ordinary high-spouted 3-light meters are liable to variations to the extent of 60 per cent., according to the height of the water-line, and that the tolerated variation is 4 per cent at the adjusted water-line—it is evident that the objects aimed at by the inventors have been in a great measure successfully attained.

We continued our experiments by subjecting a 20-light meter to similar trials, commencing with 38 lights.

EXPERIMENT *No.* 4.—20-*Light Meter.*

| Number of Lights supplied. | Duration of the Experiment. | Consumption by Test Meter in Feet. | Consumption by Patent Meter in Feet. | Variation per Cent. in Index of Patent Meter. | Rate of Consumption in Feet per Hour. | Friction of the Meter in Tenths of an Inch of Pressure. |
|---|---|---|---|---|---|---|
| 38 | m. s. 8 17 | 19·94 | 20·00 | 0·3 fast | 144·4 | 1·75 |

We then added water till the syphon became flooded and the lights extinguished, which took place by the addition of 70 cubic inches of water. We then repeated the same experiment with 60 cubic inches of water, added after the overflow-plug had been replaced.

EXPERIMENT *No.* 5.—20-*Light Meter.*

| Number of Lights supplied. | Duration of the Experiment. | Consumption by Test Meter in Feet. | Consumption by Patent Meter in Feet. | Variation per Cent. in Index of Patent Meter. | Rate of Consumption in Feet per Hour. | Friction of the Meter in Tenths of an Inch of Pressure. |
|---|---|---|---|---|---|---|
| 38 | m. s. 8 8 | 19·94 | 20·00 | 0·3 fast | 147·0 | 1·75 |

It will be seen that the registration was not affected by the additional quantity of water; but, being desirous of trying the effect of passing a larger quantity of gas, and there being no means of burning more, we opened a cock leading into a chimney-flue by which the gas could escape.

EXPERIMENT *No.* 6.—20-*Light Meter.*

| Number of Lights supplied. | Duration of the Experiment. | Consumption by Test Meter in Feet. | Consumption by Patent Meter in Feet. | Variation per Cent. in Index of Patent Meter. | Rate of Consumption in Feet per Hour. | Friction of the Meter in Tenths of an Inch of Pressure. |
|---|---|---|---|---|---|---|
| Not determined | m. s. 6 55 | 19·99 | 20·00 | 0·05 fast | 173·4 | 2·25 |

It now only remained for us to ascertain the effect produced by reducing the consumption to a low rate; but, as the burning of 20 feet of gas through a single burner would have occupied several hours, we thought our object would be sufficiently accomplished by burning four lights.

EXPERIMENT *No.* 7.—20-*Light Meter.*

| Number of Lights supplied. | Duration of the Experiment. | Consumption by Test Meter in Feet. | Consumption by Patent Meter in Feet. | Variation per Cent. in Index of Patent Meter. | Rate of Consumption in Feet per Hour. | Friction of the Meter in Tenths of an Inch of Pressure. |
|---|---|---|---|---|---|---|
| 4 | h. m. s. 1 6 40 | 19·87 | 20·00 | 0·65 fast | 17·8 | 0·9 |

The surplus-water reservoir will hold 208 cubic inches of water, available to compensate for the waste by evaporation; and, as the meter will register correctly with a surplus of 60 cubic inches, there is ample provision both for the abstraction of water by evaporation and for an increase by condensation.

We also tested the effect of suddenly opening and closing the gas supply-cock, and found no inconvenience to arise on this head. The flow of gas was steady and uniform, and the pressure was not sensibly affected by the action of the pumping machinery.

Our experiments lead us to the conclusion that the patent meter is a practical and substantial improvement upon the ordinary wet gas-meter, inasmuch as the capacity of the measuring-chamber is not diminished by an excessive supply of water, nor can it be increased by drawing off water. On the one hand, therefore, the consumer is protected against any intentional or negligent overfilling of the meter, the result of which is to exaggerate the registered quantity of gas actually consumed; and, on the other hand, the gas manufacturer is protected against the fraudulent abstraction of water by the consumer, the effect of which in the ordinary meter is to cause it to register less gas than is really supplied. Time alone can determine whether these advantages are gained at the expense of its durability, or by any complexity which may render its utility doubtful; but, so far as we are able to form an opinion upon these points, the patent meters are not liable to any greater derangement than the ordinary wet meters, nor do we believe they will be less durable.

We ought to remark that these meters require to be adjusted and tested after being worked a short time under pressure, in order to give the pumping apparatus sufficient time to raise the water to the proper level in the measuring-chamber. Should this precaution have been neglected, the meter will register rather more than the correct quantity of gas supplied after that level has been attained; and this is an error into which persons who are accustomed to the testing of ordinary wet meters are liable to be led in testing the patent meters.

We have already condemned by implication the practice of transmitting more gas through a meter than it is intended to supply. That quantity is regulated by manufacturers generally upon the basis of 100 revolutions of the measuring-drum per hour, and any increase upon this speed is attended with such diminution in the effective pressure of the gas after it has passed the meter, that our having made experiments at greater speeds must not be taken as an expression of our approval of the system of propelling meters at three or four times their proper speed; on the contrary, we condemn it strongly, as involving an increase in the pressure at which the gas will have to be supplied in the mains, and a consequent augmentation in the leakage.

(Signed)

GEORGE LOWE, *C.E., F.R.S., Engineer-in-Chief to the Chartered Gas Company.*

JOHN KIRKHAM, *C.E., late Engineer-in-Chief of the Imperial Gaslight Company.*

GEDDIE PEARSE, *late Engineer-in-Chief to the Incorporated and Provincial British Gaslight Companies.*

THOMAS G. BARLOW, *Civil and Consulting Gas Engineer.*

## CONTENTS.


| | PAGE |
|---|---|
| *Leading Articles:*— | |
| Notes upon Passing Events | 3 |
| *Circular to Gas Companies* | 5 |
| *Register of New Patents:*— | |
| Mitchell's Improvements in Purifying Paraffine | 7 |
| Carter's Improvements in Gas-Burners | 7 |
| Allardice and Miller's Improvements in Gaseliers | 7 |
| Robertson's Improvements in Apparatus for Regulating the Flow or Passage of Fluids | 7 |
| Clibrans' Improvements in Apparatus for Distributing, Governing the Pressure of, and Lighting Gas | 8 |
| Manning's Improved Mode of Intercepting and Treating Sewerage | 8 |
| Provisional Protection | 8 |
| *Legal Intelligence:*— | |
| Court of Chancery.—Scott and Another *v.* the Corporation of Liverpool and Hawksley | 8 |
| Vice-Chancellor's Court— | |
| Baroness Windsor *v.* the Cardiff Water-Works Company | 11 |
| The Penarth Harbour Company *v.* the Cardiff Water-Works Company | 12 |
| Greenwich Police Court— | |
| Charge of Stealing Gas | 12 |
| Embezzlement by a Gas Company's Collector | 12 |
| *Miscellaneous News:*— | |
| Mr. Flintoff's Reappearance in Dublin | 12 |
| The Manchester Gas-Meters | 14 |
| Presentation at the Surrey Gas-Works, Rotherhithe | 14 |
| The Salford Gas-Works | 15 |
| Public Lights at Croydon | 16 |
| Dr. R. Angus Smith on the Air of Towns | 16 |
| A Costly Substitute for Gas | 19 |
| Cuban Gas Manufacturing Company | 19 |
| Gas Controversy in Brooklyn, Long Island | 19 |
| The Meter Question in America | 19 |
| The Leicester Corn Exchange Clock | 19 |
| Silicates applied to Cements and Paint | 19 |
| *Price Current* | 20 |


## TO CORRESPONDENTS.

MR. T. A. HEDLEY'S *communication throws no additional light on his mysterious experiments at Luton, and as the whole matter is now fairly before the public, it is better for all parties that recrimination should cease.*

*The writer of a letter signed* "A HIGH-SPOUTED METER," *must send us his name and address before we can insert his communication. It is scarcely credible that the practice of overfilling meters can have been defended on the grounds alleged, but should the writer be able to substantiate his assertions the matter must undergo investigation.*

## NOTICES.

Subscribers who have not paid their subscription for 1858, or for any previous years, are requested to remit the same forthwith, in the manner specified below.

The subscription is 15s. per annum, if paid in advance during the month of January, or 18s. credit, in two sums of 9s. each, in July and January of each year. Post-Office orders must be made payable at the Charing-Cross Money-Order Office, to William H. Bennett, No. 42, Parliament Street, Westminster.

The next number will be published on Tuesday, Jan. 18, and the subsequent numbers on each successive alternate Tuesday.

Stamped copies, when forwarded by post, must be folded so as to expose the stamp; they are otherwise liable to the full postage charge for letters.

This JOURNAL has been duly registered at the General Post Office for transmission abroad.

All Communications to be addressed to the Editor, No. 42, Parliament Street, Westminster; and orders for Advertisements to the Publisher, Mr. W. B. King, No. 11, Bolt Court, Fleet Street.


# THE JOURNAL OF GAS LIGHTING,
## WATER SUPPLY, & SANITARY IMPROVEMENT.

*TUESDAY, JANUARY* 4, 1859.


## NOTES UPON PASSING EVENTS.

IT appears that the Metropolitan Board of Works are likely to have some trouble with their Engineers and Contractors on a subject which has already frequently been brought before the Law Courts. Tenders were lately received by the Board for a portion of the Intercepting Sewer, and a judicious selection of the parties tendering was, no doubt, made; but now the successful competitor is said to have refused to sign the contract, unless a clause be inserted to enable him to insist upon an Arbitration, in case of a dispute between himself and the Engineer. We are not in a position to say decidedly what amount of truth there may be in this rumour; knowing, however, the strong feeling of the London contractors on the subject of the Arbitration clause, it seems to us to be more than likely that a stand should at once be made in this matter, and that an attempt should be made in order that the principle should, if possible, be established before the great work of the London sewerage is begun. If even our information should not be correct, the question itself is only delayed; it must, sooner or later, force itself upon the attention of the public, for the present unsatisfactory state of the connexion between Engineers and Contractors cannot be allowed to continue without serious prejudice to the public service.

The principle involved in the rumour above mentioned may briefly be stated as follows. It is customary at the present day, in specifications for Engineering works, to insert a clause whereby the engineer reserves to himself the right of deciding finally, and without appeal, any disputes which may arise with respect to the meaning of the contract, or as to its mode of execution. Anything more monstrously unjust than this clause it would be difficult to imagine; for by it the Engineer, the *de facto* paid servant of one party to the contract, is made sole referee and umpire in case of dispute. Hitherto there has been great uncertainty as to the opinion of our courts of Equity on such matters; but the recent decision in the case of *Scott v. the Corporation of Liverpool* shows that it is possible to draw a clause, such as we allude to, in such a manner as to ensure its legal validity. To the honour of the Engineering profession in England it must also be said that the great power conveyed by the arrangement in question has very rarely been abused. But at the outset of a work of unparalleled magnitude, at a time too when the Engineers of the Metropolitan Board of Works avowedly, and designedly, shrink from anything like a scientific definition of the terms they employ, or of the nature of the materials they are about to use; at such a time, we believe conscientiously that Contractors are only asking for what they are strictly entitled to, when they insist upon the introduction of a new clause in their agreements, whereby they may secure to themselves something like an equitable tribunal in case of dispute. The quarrel, as it now arises between Engineers and Contractors, arose some years since between Architects and Contractors; and, fortunately for all parties, the Architects were beaten. Since that day the relations of Architect and Contractor having been more equitable, have been more satisfactory to all parties; and sure we are that when the Engineers of the Metropolitan Board examine the question now raised calmly, dispassionately, and without reference to their former habits, they themselves will be the first to acknowledge the injustice of the position they now assume. Whether they do or not so acknowledge the injustice, we hope that the London contractors will adhere to their position, and that shortly this very equivocal clause of modern Engineering specifications may be forgotten. That it has been powerless to prevent litigation is evident from the cases of *Ranger*, and of *M'Intosh v. the Great Western Railway Company*, and from that of *Scott v. the Corporation of Liverpool*; but even were the clause ever so binding, its injustice is not the less flagrant,—and it is on this score, especially, that we are anxious to see its final repeal.

We have not yet been able personally to visit Windsor; but from the semi-official publication of Mr. Austin's Report to the Lord President of the Council (of the Privy Council, we suppose) it would appear that some monstrous negligence has been tolerated, some gross blunders committed, in consequence of the mixed action of the Ordnance and of the late General Board of Health. Mr. Austin tells a sad tale of the errors of omission and commission of Captain Vetch (a man whose name, by the way, is always met with when any such mischief is in the wind) and of the Local Board of Works; but, if all Mr. Austin says be true, we humbly submit that the control of the late Central Board of Health, of which Mr. Austin was once Engineer-in-Chief, or Secretary, has been utterly useless. So far as Windsor is concerned, the engineering talent of Whitehall has been of no avail; nay, rather the inhabitants have been deluded by the semblance of a Government inspection by so-called competent Engineers, and have thus been allowed to waste their money on notoriously ill-designed and ill-executed works. The official report is the bitterest satire which could possibly have been penned against official superintendence; but, unfortunately, the public runs so fast now-a-days towards the easy repose of administrative "protection," that it cannot stop to read the lessons thus cast before it. It is worthy of especial remark also, that the most striking illustrations of the existing evils at Windsor are precisely connected with the Royal Mews and the Infantry Barracks. Evidently, the "educated men" employed by the Government have not succeeded

"in preventing," or even in extenuating, "epidemics;" and as there can be no doubt with respect to the necessity for adopting Mr. Austin's recommendation to the Local Board, "to employ some competent surveyor to examine the house-to-house drainage," we sincerely hope that the Windsor people will seek for advice and assistance in quarters very different from those whence they have hitherto only derived loss and misery. Really, it would now appear to be necessary to adopt some vigorous method of checking engineering empiricism; and if the country is to be much longer cursed with the Richmond Terrace inspections, it will be necessary to compel some examination of the parties there employed. At present, from the style of documents issued by these highly-paid officials, it would seem that the examination of landing-waiters would be a stumbling-block to them; and yet it is coolly proposed to leave a very large portion of the local taxation of the country at the mercy of the very men who have already proved themselves to be so incapable, and have done so much mischief. A corps of certified Government Engineers, such as exists in all foreign countries of civilized Europe, is, no doubt, a very serious evil; but at any rate it would be preferable to the impudent quackery of the late General Board of Health, as the latter is shown to have existed by even official Reports. If the country must be overridden by the Central Government, which unfortunately seems to be the tendency of the age, at least let us have a Central Government administered by men who are acquainted with the first principles of the sciences they are supposed to deal with, and who know something of their own language. Mr. Austin's Report induces us to believe that at Richmond Terrace neither of these qualifications are necessary, or at least indispensable.

A short time since, the Town and Channel Commissioners of Colchester laid a case before that very equivocal legal authority, Mr. Tom Taylor, requesting his official opinion as to their power to adopt portions of the Local Government Act, 1858; and the eminent farce adapter in question replied that the Commissioners could adopt part or parts of the Act under the provisions of the 15th section, or they might adopt the whole Act under the provisions of the 12th section. Now, the case, as it appears to us from the public papers, was very badly stated, and about as ill answered. Section 15 of 22 & 22 Vic., c. 98, says that the Act may be adopted in whole or in part, by any corporation or body of commissioners *exercising powers for sanitary regulations;* but the question at once arises as to the meaning of the term "exercising powers for sanitary regulations." Then arises the graver question as to whether the powers of the Act can be exercised by bodies not subject to the ordeal of popular election, such as is provided by the said Act? and whether the section 24 would not render the independent existence of such Improvement Commissioners illusory? This, at any rate, is certain—viz., that the last portion of section 15 would place Local Improvement Commissioners entirely under the control of one of Her Majesty's principal Secretaries of State, so far as their borrowing powers might be concerned, and any one who may have followed the history of the gradual encroachments of the Central Administration of late years, must know the danger attending this provision of the Act. It must, however, be confessed that the Local Improvement Commissions are usually so jobbed and mismanaged that there is a possibility of the public's gaining something by the substitution of any measure which ultimately must render necessary the abolition of the ordinary irresponsible Commissions, even though the actual proceedings of the General Board of Health were not of a nature to inspire confidence in official science. It is strange, nevertheless, that any Local Commissions should run, as it were, into the halter, by supposing that they can adopt part of the Act of 1858 without eventually falling under the whole of it. Unfortunately, there seems a tendency amongst the bodies thus referred to to abdicate their own independence; so that the only true course open to the public would be to compel the Government to do its duty in carrying out the existing law properly, or in correcting its defects.

We hear little of the doings of private companies, or of public bodies, for the purposes of sanitary improvement; or at any rate there are no new principles, no new methods of construction, involved in the works now in hand. At Rugby it appears that the boring originally made is in progress of enlargement, and that, after all the fuss and nonsense talked about the gathering grounds, underdrained, the ordinary methods of obtaining water must be resorted to. Still, the experiment of a bore-hole in the new red sandstone near Rugby is an interesting, and perhaps a hazardous one, and the progress of the work will be watched with interest. Altogether, the water-bearing capacities of the new red sandstone are involved in uncertainty, and it therefore becomes more necessary to collect practical information on the subject. The results of the pumping operations at Liverpool and at Birkenhead, for instance, seem to indicate that very different conditions may obtain in portions of this formation separated from one another by very small intervals; or at least that the exhaustion of the stratum by pumping in one locality does not necessarily involve an interference with the supply at a very insignificant distance. Thus at Birkenhead there is a very large supply obtainable from the new red sandstone, by borings of 395 and 405 feet in depth, even whilst the wells at Liverpool are insufficient for the supply of the town. No doubt some fault or subterranean disturbance affects this matter; but the very appearance of an anomaly renders the inquiry into its nature and causes of interest. We have obtained, by the kindness of some friends, a few valuable notes on the wells in the red sandstone, and elsewhere. They shall be put together in the form of a separate notice, which may perhaps elicit further information on the subject.

We call the attention of our readers to the article by Dr. Angus Smith, which we have reprinted from the "Quarterly Journal of the Chemical Society," on account, firstly, of the merits of the article itself; and, secondly, on account of the importance naturally attached to every production emanating from a man of Dr. Smith's acknowledged eminence and ability. Yet we must confess that the article in question, with all its undoubted merit, strikes us as being an unphilosophical and a very unsatisfactory one. Dr. Smith, like most English authors of the present day, seems to consider that attention to language, and to strict grammatical construction, is a matter of small importance; and so the portions of his essay wherein he attempts anything beyond a record of experiments, are written in a style which renders it almost impossible to identify his meaning; whilst, whenever the learned doctor appears to have wished to imitate the wordy nothings of Mr. Simon, and to attempt "fine writing," the result has been that he has disfigured the record of a very useful series of investigations by a great deal of twaddle. Perhaps it is hypercritical to expect from chemists a strict adhesion to the laws of composition when the Acts of Parliament, and nearly all official publications, are written in utter defiance of those laws; but the philosophical errors, as we consider them, of Dr. Smith's essay cannot be passed over thus lightly, nor can they be allowed to circulate, without at least an endeavour to call public attention to the necessity for examining the doctrines connected with them.

Dr. Smith certainly shows, in a very elegant manner, the relative compositions of the atmosphere in town and country. He has done good service in ascertaining the amounts of the various descriptions of impurity to be met with in and around Manchester; but there is nothing in his recorded observations which satisfactorily accounts for the waste of human life we are told invariably exists in towns. It appears that there is, at ordinary periods, a notable excess of carbonic acid in the atmosphere of Manchester, but there is nothing in the essay to explain in what manner this agent is so fatal, as it is said to be, upon both vegetable and animal bodies; and, indeed, we would add that it would be very desirable to investigate the precise function of vegetation in restoring the composition of the air, a point upon which it would seem that Dr. Smith is hardly prepared to agree with former writers on physics. The remarks upon the proportions of the sulphur-acids are curious; and they prove, amongst other things, that the avoidance of dense black smoke is far from being always desirable. When the coals used contain large proportions of sulphur, the evolution of soot from the chimney tops seems actually to counteract the mischief arising from the sulphureous vapours; and if this be correct, there can be little reason to admire the empirical legislation which would render compulsory the non-formation of visible smoke, whatever be the nature of the coal burnt. It is, however, in the portion of the essay wherein Dr. Smith treats of the effects and the estimation of the organic matter contained in the air that he seems to us to have made the most extraordinary errors. Thus, after stating that the amount of organic matter in the atmosphere varied between the limits of 1 grain in 8000 cubic inches to 1 grain in 209,000 cubic inches—the quantities respectively observed in the air of a closely packed railway-carriage and in the air obtained from the open hilly country—Dr. Smith goes on to state that the

amount of organic impurity in the air obtained by passing a current over putrefying animal matter was, at the beginning, 1 grain in 25·5 cubic feet; then, 1 in 45; then, 1 in 51·9 cubic feet; but he seems to have forgotten, in a most unaccountable manner, that 1 grain in 25·5 cubic feet is equivalent to 1 grain in 35,424 cubic inches, 1 grain in 45 cubic feet to 1 in 77,760 cubic inches, and 1 grain in 51·9 cubic feet to 1 in 89,683. It would thus appear that the air of a close railway-carriage is more objectionable on the score of the organic impurity it contains than the air derived from immediate contact with putrefying matter! Surely there is some error here, either of the printer or of the calculator, which it would be desirable to clear up, for the reasoning in the original essay is evidently based upon some figures which do not appear in it as it now stands. Dr. Smith's remarks upon the effects of the atmosphere upon blood are strikingly interesting, but they also are unsatisfactory in as provoking a degree as many other parts of the essay; and we earnestly hope that the path thus opened up for investigation will be followed by other observers. Perhaps, for instance, the able chemists who are engaged in ascertaining the action of light and air upon photographic pictures may be able both to derive benefit from Dr. Smith's observations on the manganates of potash, and to advance the investigation beyond the point where he leaves it. There is so much of value in the paper itself to which we refer, that we earnestly hope soon to find that its shortcomings may be compensated for, and the few errors it contains rectified by its author himself. But certainly, in the present state of the investigation into the constitution of the air of towns, there is nothing very satisfactory yet upon record as to the relative influence of that air upon human beings. All that Dr. Smith says about the proportions of carbonic acid, of sulphur-acids, of organic impurity, of ammonia, &c., in the air, may be true; but there still remains for our investigation the extent and nature of the modifications produced by the mysterious power of life; and with respect to the health of the population, we have still to learn the effect of habits, occupations, of vice, and of virtue, upon the rate of its mortality. Dr. Smith, like too many observers, only looks, we suspect, at the part of the inquiry he is immediately interested with by his own avocations.

## Circular to Gas Companies.

The events of the past year in which the interests of gas companies are concerned, present a chequered picture of light and shade, but in the general aspect brightness greatly predominates over gloom. So far, indeed, as regards the essential point of consumption, everything appears cheering and full of promise, and we may congratulate all established companies on the increase of their rentals, accompanied in most cases by increase of dividends, the latter result having been materially aided by the low prices of coals and, with a few exceptions, by the fair prices obtained for the residual products. As regards the demand for gas, therefore, and the profits realized by the extension of gas illumination, the prospect is fair and encouraging; the shaded parts of the picture are produced almost exclusively by the interference of parliamentary and other authorities with the natural course of commercial operations, from which interference gas companies continue to be annoyed, and their business to be impeded, in a more vexatious manner than any other manufacturing interest.

At the commencement of the year the question of the gas supply to the metropolis was in full agitation. It continued to attract much attention throughout the whole session of Parliament, and it promises to be renewed with increased vigour when Parliament again meets. This is a subject of interest not in London alone, but in all large towns where there are competing companies; and however the matter may be ultimately settled, a useful lesson may be gained by gas companies as well as by gas consumers. The gas consumers of the metropolis have already experienced the folly of encouraging useless competition, and the districting arrangement in which that competition has terminated, is but the natural consequence and the inevitable result of a mutually injurious competition. The agitation which ensued when the consumers found themselves dependent on only one source of supply was also the natural result of that practical exposure of their previous folly; and had it been confined to the attainment of reasonable and legitimate objects, the *primâ facie* evidence in favour of the agitators was sufficient to have gained them such redress as was required. Their extravagant demands, however, accompanied by flagrant misrepresentations, deprived them of impartial sympathy, and the miserable display they made before the committee of the House of Commons appointed to inquire into their grievances has placed them in a much lower position than they occupied before the inquiry commenced. At the same time it must be observed that the districting arrangement having placed the consumers at the mercy of the gas companies, and being calculated to excite alarm, it was impolitic not to have given the consumers full assurance that the change should not prejudice their interests. Had the metropolitan gas companies voluntarily guaranteed a reasonable maximum price, a minimum quality, and equitable conditions of supply—such as would assuredly be enforced if the question were brought before Parliament—the existing discontent and bitterness of feeling would have been avoided; and if parochial agitators had still attempted a movement against the gas companies, they would have met with but few supporters. The practice of liberality and courtesy, as well as of honesty, is the best policy in the dealings of gas companies with the public, of which the metropolitan gas agitation affords an example. The companies are now willing to grant terms which, if voluntarily offered in the first instance, would have produced cordiality and good-will instead of severance and enmity. The metropolitan gas companies now offer to deal liberally with their customers, and, so long as they act up to their professions, they need not fear the impending storm raised by envy and selfishness.

The meter question, which forms one of the elements of discord between the metropolitan parishes and the gas companies, has also been a subject of dispute in Manchester and in other towns in the kingdom. The case attempted to be got up against the company in Liverpool completely failed; for out of 4246 meters examined by the inspector appointed for the purpose, only one was found to be incorrect, and that one registered against the company. In Manchester, we regret to say, the case is different. That abuses have arisen there from the overfilling of the meters has been proved beyond a doubt, and the persistent use of high-spout meters by the manager of the Manchester Gas-Works, after the proved abuses practised by overfilling them, shows a disregard of the well-grounded complaints of the consumers that would not be tolerated in the management of a company. The conduct of the gas committee in shrinking from the promised investigation of the charges preferred against their officers is not calculated to inspire confidence in the management of such a body, as it indicates a consciousness that it is necessary to screen their servants from public obloquy. A diminution of the Manchester gas-rental is said to have occurred since public attention has been directed to the registration of the meters, whilst the make of gas continues the same. Should this prove to be the fact, the deficiency may be taken to represent the overcharge to consumers above the quantity of gas that actually passed to the burners. During the angry controversy that has taken place on this subject, we have held aloof from the contentions of rival meter manufacturers, whilst we have felt it to be our duty to insist on the necessity of a searching investigation of the charges made against the officers of the corporation, and to warn the gas committee against the public scandal of seeming to abet their servants in giving short measure. The committee should bear in mind the proverb of Solomon about a false balance, and should place reliance on the adage that "honesty is the best policy." The use of meters which it is well known may be tampered with should not be permitted; and it is to be hoped that Parliament will interfere to prevent the continuance of such abuses. No measuring instrument has yet been contrived that *fully* answers all the required conditions of a perfect gas-meter, and inventors would do well to direct their attention to this subject rather than occupy themselves with impracticable schemes that can be of no possible utility.

The decision of the arbitrators on the matters in dispute between the Great Central Gas Company and their contractor, Mr. Croll, was an event that excited much interest at the commencement of the past year. The evidence given during the twenty-four days that the arbitration continued afforded much curious and valuable information, not confined to the question immediately at issue, and we have accordingly devoted a large portion of the Journal to its publication. The point that comes out prominently in this inquiry is the confirmation of our oft-repeated declaration that four-shilling gas in London is an illu-

sion. The notion on which Mr. Croll founded his contract with the company was, that he could manufacture gas for 10½d. the 1000 feet, and that he should consequently derive a profit of 6d. per 1000 by selling it to the company at 1s. 4½d. His contract, however, practically entailed a loss upon him of £17,000, notwithstanding he had subsequently an allowance of 25 per cent. for leakage, which allowance considerably exceeded the quantity of gas unaccounted for. The company have, indeed, procured other contractors to supply them nominally on the same terms as Mr. Croll, and so long as they can deliver gas costing them only 1s. 9d. per 1000 feet, they can sell with profit at 4s.; but how long that contract will continue time only can tell. Judging from past experience of the consequences of resting on such an illusory foundation, another convulsion may be expected to overthrow again the calculations of the chairman of large dividends from four-shilling gas.

Among other points of interest brought into notice during the proceedings before the arbitrators was the discordance in the results of photometrical experiments, undertaken by persons who from their position and experience might be supposed careful operators. A difference of 25 per cent. appeared in the estimations of the illuminating power of the gas supplied by Mr. Croll, according to the mode in which the experiments were conducted. These extremely varying results in the use of the Bunsen photometer show that there is still wanting some more certain mode of measuring the intensity of the light as well as of measuring the volume of gas.

Not deterred by the exposure of the four-shilling gas delusion in London, Mr. George Flintoff has reappeared on the scene in Dublin, to set afloat the still more impracticable project of lighting that city with gas at 3s. 6d. per 1000 feet. The "Dublin Independent Consumers' Company," under Mr. Flintoff's management, are to do wonders, as appears from a report which we have given in another column, wherein the plan is fully expounded. Mr. Clegg, Mr. T. A. Hedley, and Sir John Macneill are the authorities quoted as sanctioning the supply of 14-candle gas to private consumers in Dublin for 3s. 6d., and the lighting of the public lamps for 2s. 6d. per 1000 cubic feet; and Mr. Flintoff further promises the shareholders, after paying them dividends of 10 per cent., to reduce the price to 3s. As a specimen of the data on which he founds his calculations, it may be sufficient to mention that he starts with the refuted proposition that the price of coal has nothing to do with the price of gas, for by selling the coke at 10s. a chaldron, and the tar at "*one shilling a gallon*," the cost price of the materials for making 1000 feet of gas was shown to be only 4d. Whether in the progress of science, which Mr. Flintoff talks about, he has discovered the means of distilling coal without fuel does not appear, but he made no allowance for fuel in his estimates. By proceeding on such a plan, it would not be difficult for less clever men than Mr. Flintoff to concoct schemes for lighting the Irish metropolis on still lower terms. If there be any person in Dublin inclined to believe the glowing representations with which it is intended to induce them to take shares, we strongly recommend such individuals to compare the evidence given before Parliament in support of the Great Central Gas Consumers' Company with the evidence given before the arbitrators on Mr. Croll's claims after the real value of the estimates and representations in support of four-shilling gas in London had been tested by sad experience.

The action brought by Mr. F. C. Hills against the London Gas Company for an alleged infringement of his patent for purifying gas with oxide of iron, is a question of greater general importance than the dispute between Mr. Croll and the Great Central Gas Company. Putting aside the circumstances tending to show that Mr. Hills was indebted for the invention which he claims to having witnessed the experiments of Messrs. Laming and Evans, and also disregarding the point that the patent is technically invalid owing to irregularity of the title, the real question in dispute is, whether the oxide of iron claimed by Mr. Hills is a different kind of oxide from that previously patented by Mr. Croll and by Mr. Laming. This question, the decision of which requires an intimate knowledge of chemical combinations, was sent for solution to a jury of Surrey farmers, after Mr. Hills had been non-suited in the Court of Exchequer. Mr. Hills claims the hydrated oxide of iron, and contends that no other form of the oxide possesses the power of freeing impure gas from sulphuretted hydrogen. It was proved at the trial, and is well known to chemists, that the property which the oxide of iron possesses of combining with sulphur, depends more on the mechanical condition of the molecules of the metal than on its chemical state of combination with oxygen and water; and further, that hydrated oxide of iron may become anhydrous during the process of revivification, and is in that state a more active purifying agent than the original hydrated oxide. Though the Surrey farmers gave a verdict in favour of Mr. Hills, the question is far from being set at rest. A rule for a new trial has been granted; and even when the action against the London Gas Company is decided, there remain several actions against other gas companies which may be brought to trial. Here, then, is a fruitful crop of litigation in prospect to establish the validity of a patent for an invention the real value of which is admitted to be due to the discoveries of others. Mr. Hills' hydrated oxide of iron, even allowing him all that he claims, would be of no practical use but for the process of revivification by exposure to air, which was originally discovered by Mr. Laming, and afterwards by Mr. Evans. The annoyance and obstruction to improvement which petty monopolies present, are truly exemplified in this patent granted to Mr. Hills for an invention that would be valueless but for the application discovered by others, who have no patent in England, and who might be prevented, if Mr. Hills' patent be valid, from availing themselves of the discovery which gives value to the invention. These monopolies are objectionable also on the ground that those who are not sufficiently rich to defend their legal rights may be defrauded with impunity, whilst in the hands of richer men they become instruments of extortion, by the dread of litigation. Upwards of £7000 have been already expended in the attempt to establish the validity of Mr. Hills' patent, including the cost of printing the shorthand writer's notes, which fill an octavo volume of 679 pages. Various suggestions have been made for an amendment of the patent laws, and it is intended to bring in some measure on the subject in the ensuing session of Parliament; but the main object of the alterations that have been proposed is to reduce still further the cost of a patent. Such a measure would only increase the evil, unless restrictive provisions were introduced limiting the grant of patent privileges to useful inventions that are really new.

We have alluded to the proceedings of Parliament as bearing unfavourably on gas interests during the last session. This feeling has, indeed, been manifest for some years past; for though there is less disposition than formerly to encourage competing companies, yet those undertakings that are allowed to be established, and the existing companies that apply to Parliament for new powers, obtain less favourable conditions. The proceedings during the last session exhibit a desire on the part of committees to lower the price of gas, to increase its illuminating power, to impose restrictive clauses in dealing with vested profits and new capital, to limit the amount of dividends, to restrict the erection of works to present localities, and to reduce the quantity of land to be purchased. There was also a manifest disposition to discourage guaranteed shares, and to increase the suffrage of shareholders. In no instance was the dividends of shareholders of new capital permitted by the committes to exceed 7½ per cent., and in dealing with preferential interests the holders of such shares were not allowed to participate in any extra profits, even in cases where the ordinary shareholders were allowed to divide 10 per cent.; and in some instances the dividends on preference shares were limited to 5 per cent. These restrictions of profits have a tendency to discourage investment of capital in gas companies, and had they been imposed at an earlier period, when such undertakings were considered speculative, rather than safe objects for investment, this kind of interference might have had a seriously prejudicial effect; but, under present circumstances, they cannot do much injury, so long as the permitted rate of dividends exceed the usual rates of interest.

Among the interferences of petty authorities with the free action of gas authorities, we may notice the outrageous decision of Mr. Pitt Taylor, the Judge of the Lambeth County Court, to the effect that gas companies are under obligation to supply every person with gas who may require it, though there be no clause in their Acts rendering supply compulsory. The question has, however, been removed to a superior court, and the opinions of the judges are to be taken on this construction of the rights of gas companies, but it is very uncertain whether the case will ever reach Westminster Hall.

After noticing the external circumstances which have affected gas interests during the past year, we now turn to con-

sider the improvements that have been made in the manufacture of gas by the more economical application of residual products. Large revenues are now derived by some companies from the adoption of our advice to arrest the ammonia carried off by the gas, which generally amounts to twice the quantity contained in the ammoniacal liquor. Care should be taken, however, not to carry the absorption of the ammonia too far, for it is desirable to retain a small quantity of it in the gas to prevent the deposition of naphthaline. Much yet remains to be done with the gas refuse, so as to convert that which is now considered almost worthless into valuable products. For instance, the sulphur deposited in the oxide-of-iron process of purification might be roasted, and converted into sulphuric acid; and the quantity of acid thus produced would be nearly sufficient to neutralize all the ammonia in the gas. The tar, which is a drug in England, has in Paris been successfully converted into various useful substances, such as benzine, oils for burning, lamp-black, asphalte, and it has also been made the basis of a smokeless kind of fuel, which is used in cooking-stoves as a substitute for charcoal. It has been estimated that, assuming the weight of coal distilled in London in a year to amount to 600,000 tons, the product of the sulphate of ammonia and of purified oil extracted from the tar would, if properly economized, realize upwards of quarter of a million. This important source of income is now in a great measure neglected or wasted from the want of skilful application of practical chemistry to gas refuse. By attention to these details of management, the revenues of gas companies might be materially increased; and such addition to the present prosperity which most of them enjoy might be followed by a reduction in the price without diminishing dividends. The consumers would thus participate in the advantages to be derived from the adoption of improved processes, and the existing gas companies would be placed in a still more stable position.

Whilst offering our congratulations on the improved condition of the affairs of gas companies in general, we should not omit to notice the extinction of all those rival schemes of illumination which at one time threatened to eclipse gas lighting altogether, and formed a constant source of alarm to gas interests. The last of those schemes that had assumed a tangible form was extinguished with the winding-up of the Electric Light, Power, and Colour Company. Several new projects have, indeed, been raised on that hot-bed of speculation, the Paris Bourse, but none of them have attracted much attention, with the exception of the Honourable Colonel Fitzmaurice's "Life Light," which threw its brilliant rays on the Emperor's barge at Cherbourg, and has been carried about in carpet-bags, to the wonderment of all beholders. Respecting the economy of this marvellous light the old story is told, that it costs nothing; but, so far as the projectors have allowed the process of production to be known, this nominally costless light is one of the most expensive sources of public illumination that has yet been proposed, and is far less feasible than hydro-carbon gas, or many other of the new lights that have dazzled the world. Yet all those promising plans have, one by one, disappeared, and there is little probability that any other means of artificial lighting will be invented equal in cheapness, cleanliness, convenience, and safety to well-purified coal gas.

## Register of New Patents.

1251.—JOHN MITCHELL, of Dunning's Alley, Bishopsgate Street Without, London, assayer, for "*Improvements in purifying paraffine.*" Patent dated June 3, 1858.

This invention has for its object improvements in purifying paraffine. Heretofore paraffine has sometimes been purified by a process consisting of mixing it with sulphuret of carbon, and then pressing it; and this treatment has usually been repeated several times, and afterwards the purification has been completed by acting on the paraffine with animal charcoal. The inventor states that he has discovered that crude paraffine may be much improved in quality by treating it with animal charcoal, or charcoal obtained from peat or other vegetable matter, or with charcoal obtained from schist or coke; and this process of purification is also applicable to paraffine which has been partially purified by any of the ordinary processes, but which has not been subjected to the action of sulphuret of carbon before the treatment with charcoal that one part of his invention consists, the other part consisting in the use of peat or other vegetable charcoal of schist or coke as a substitute for animal charcoal.

The paraffine is to be melted, and the charcoal, whether animal, vegetable, or mineral, in a state of powder is to be stirred in and mixed therewith, the paraffine being kept heated and melted for from half-an-hour to two or three hours, depending on the quantity of the paraffine. The quantity of charcoal used is about one-tenth by weight of the paraffine. The paraffine is then separated by canvass or other bag filters. Or in place of mixing the charcoal with the melted paraffine, as above explained, the charcoal may be in the state of coarse powder made up into the form of filters, and be so used; the melted paraffine being, in such cases, caused to percolate or filter through a succession of such charcoal filters (suitably heated to retain the paraffine in a melted state) till the desired purification is obtained.

Another part of this invention consists of applying vegetable and mineral charcoal in place of animal charcoal when paraffine has been first partly purified by the aid of sulphuret of carbon. In carrying out this part of the invention the treatment of paraffine with sulphuret of carbon is to be performed as heretofore practised, and the paraffine is then to be subjected to the action of mineral or vegetable carbon in like manner to that resorted to when using animal charcoal.

1267.—HENRY CARTER, of Manchester, gas engineer, for "*Improvements in gas-burners.*" Provisional protection only obtained. Dated June 5, 1858.

The burner is made in two parts, both being furnished with a jet, the upper one being formed in the usual way, and the lower one having smaller holes or orifices, the said lower part or jet at its head fitting or slipping into any of the required pipes, sockets, or elbows.

One effect of passing the gas through the small orifices of the lower jet before arriving at the top or usual jet is, that a No. 1 lower jet produces a No. 3 upper jet, and a No. 2 lower jet a No. 5 upper jet, and so on in the same proportion.

Another effect is, that the aforesaid combination or jets forms a complete regulator, so that the gas escapes evenly and burns without the starting common to the jets in ordinary use, and also effects a great economy in the consumption of gas.

A chamber can be introduced between the jets if found desirable.

1372.—JOHN ALLARDICE, brassfounder, Glasgow, and WILLIAM MILLER, manufacturer, of Blantyre, N.B., for "*Improvements in gaseliers.*" Provisional protection only obtained. Dated June 17, 1858.

This invention consists in constructing pendant gaseliers of either the fixed kind, such as crystal gaseliers used in drawing-rooms, or the sliding kind, such as the common bronzed gaseliers with a sliding tube bearing one or more additional burners, and admitting of such additional burner or burners being brought down considerably below the level of the main burners, so as to afford a stronger local light at a level convenient for reading or other occupation. Such sliding tube is never detached from the gaselier, but is thrust up inside the centre tube of the gaselier when out of use, so that no escape of gas can take place as with tubes which are made to be detached from the gaselier. In a modification of the contrivance suitable for crystal gaseliers, a sliding tube with two additional burners may be arranged to be entirely concealed within the crystal ornaments when out of use, the burner branches being made to fold up so as to occupy a very small space. These burner branches may also be contrived so that the turning of them up or down admits the gas to the burner or shuts it off, additional stop-cocks being thereby rendered unnecessary.

1413.—JAMES ROBERTSON, of Glasgow, N.B., machinist, for "*Improvements in apparatus for regulating the flow or passage of fluids.*" Provisional protection only obtained. Dated June 22, 1858.

This invention relates to valvular apparatus of various kinds, and for use in various situations, where the flow or passage of fluid is to be regulated, adjusted, and governed. As applied for the purpose, or regulating the supply of cleansing water to water-closets, it consists under one modification of a short cylindrical chamber of pretty large diameter, having a top and bottom cover screwed on. The bottom cover or end forms the actual shallow, shell, or chamber through which the supply of water from the main is brought to the apparatus. This portion is cast in one piece on the main supply pipe, being disposed horizontally—that is to say, with the plane parallel to the axial line of the main pipe, which runs along it beneath. In the centre of this end, disc, or shell there is an aperture communicating with the inlet section of the main pipe; whilst there is a second aperture slightly eccentrically disposed, and communicating with the opposite or outflow section of the main pipe, leading to the closet pan—the two apertures being, of course, completely separated by a sectional portion of metal cast in for the purpose. Upon this perforated disc shell-face, there is fitted a circular disc of caoutchouc or other flexible material, arranged to bear upon an external annular face all round the shell. This flexible disc has screwed upon each face a button or small disc-piece of metal, the under one of these small discs having fitted to it a soft or flexible face-piece of leather or other material to from a valvular fit upon an elevated annular working-face round the central hole in the shell. The central or barrel portion of the operating-chamber has attached to it a lateral water-pipe of narrow bore, and fitted with a stop-cock for setting the flow. The top cover or end-disc of the chamber has passed through its centre a vertical spindle fitted with a helical spring to keep it up. The lower end of this spindle which is passed through the cover has upon it a holding-collar or button to carry a second large flexible disc of caoutchouc, which, like the one already described, is of the same diameter as the cylinders bore. The upper cover is dished on its inner face for the elastic disc to settle into and leave more space beneath. The action of the apparatus is this:—When the closet is about to be used, the pressure upon the seat causes the main upper spindle to be depressed, and this spindle then forces down the upper flexible disc so as to contract the space for water in the cylinder beneath it, and thus force the contained water back through the lateral stop-cock into the main, the water-way through the stop-cock being purposely adjusted to pass the water slowly through. Then, on the release of the operating spindle from pressure, the water in the main pipe beneath, meeting little or no pressure from above the disc to interfere with its upward force, lifts the bottom flexible disc, and flows through from the inlet section of the main by the aperture already described into the outlet section, thus reaching the pan of the closet. This flow continues until the upper internal pressure between the two flexible discs in the cylinder is made up by the inward flow of water again through the lateral stop-cock, when the lower flexible disc will resume its seat and cut off the supply of water to the basin or pan. The apparatus is then again fit for use. Instead of the lateral adjusting stop-

cock, a minute perforation may be made through the central shell or button-holding piece of the lower flexible disc, through which the water will flow and reflow for the regulation of the main supply. According to another form, too, the upper flexible disc in the chamber may be set to rest upon a slight internal shoulder near the top of the cylindrical part of the cylinder, the cover having a central spindle passed through it to bear upon the loosely disposed flexible disc by means of a button head, and by a third plan one flexible disc only need be used. In this last case, the single flexible disc rests upon the button face of the main shell, and it has attached to it a central spindle, passing down from below through the central water-way and into a bottom guide-hole in the main shell. This spindle has a minute aperture in it for the purpose already described, and the main shell beneath it has a screwed aperture for admission to cleanse out the minute hole when necessary. The top cap of the chamber has an inverted valve-spindle, with a button end upon the part entered into the chamber; and when the closet is used, a handle is pulled to work this valve-piece, so as to depress the elastic disc beneath it, or relieve the same from pressure, as the case may be, the water above the flexible disc being allowed to escape freely away instead of being forced back into the main.

1418.—William Clibran and Joseph Clibran, of the city of Manchester, in the co. of Lancaster, machinists and manufacturers of gas-governors, for "*Improvements in apparatus or arrangements for distributing, governing the pressure of, and lighting gas.*" Patent dated June 23, 1858.

1. These improvements relate to a mode of joining pipes used for the distribution of gas, the object of the invention being to preserve a perfect joint and allow for the settlement or movement which invariably takes place after pipes are newly laid, and it consists in employing the ball and socket arrangement to form the junction between the pipes. The manner of carrying into effect this part of the invention is shown in the drawings accompanying the specification. The arrangement shown provides only for vertical movements in the pipes, but it admits of the pipes being placed in a curve horizontally. Each pipe has a ball at one end, and a socket at the other end. Each pipe has a pair of ears, having holes in them, through which a pair of bolts pass, which secure the ends of the pipes together. The heads of the bolts and the nuts are made hemispherical, and fit into corresponding cavities formed in the ears. The centre of the hemispherical cavities in the ears on the ball end of the pipe are both in a line drawn through the centre of the ball, and when the pipes are placed in the position they are intended to occupy, a plane passing through the centres of the two connecting-bolts will be horizontal. The joint is made by a ring of greased cloth placed between the ball and the socket. This arrangement will maintain a perfect joint whilst admitting of vertical settlement or movement taking place in newly laid pipes.

2. The improvements relate to gas-governors and stop-taps, and consist in a peculiar combination of the two in one. The bottom part of the gas-governor case has passages formed in it, conducting the gas to and from the governor, and in one of these passages a valve-facing is formed, and a receptacle for a screw-plug, which is brought to or from the valve-face by rotation. The gas having entered the compartment, passes through the valve-facing orifice and through the governor-valve into the "gasholder," from which it passes through the orifice into another compartment, and thence it goes to the meter or to the pipes leading to the burners. The plug of the valve screws through a part forming the gland, which keeps the packing tight against the spindle part of the plug, the part forming the chamber for the packing being screwed into the case. The plug of the valve is rotated by a handwheel screwed on it.

3. The improvements relate to small gas-governors intended for single lights, and are peculiarly applicable to street lamps. They consist in a peculiar arrangement and construction of the valve-passages, intended to provide principally against the stoppages of such passages by the entrance of the mercury used as a seal to the "gasholder." The main peculiarity is in the return-passage after the gas has passed through the valve of the governor, and consists in forming an annular cavity under the seating part of the valve, which cavity, when the valve-seating is fixed in the casing part of the gas-governor, forms a portion of the passage to the outlet-pipe. By this arrangement the mercury cannot enter the return or valve-passages. The gas passages are drilled, and can be cleaned out if required.

4. These improvements relate to arrangements for lighting gas lamps, especially street lamps, the object being to light such lamps externally, without removing or opening the parts protecting the light from the weather or from the effects of atmospheric disturbance, and consist in the employment of a pipe-orifice, one end of which is placed or arranged so as to come directly opposite and over the gas-burner orifice, the other end being brought to the outside of the lamp or protecting-cover. It is found that when a pipe is so arranged it is only necessary to apply a light to the orifice of the pipe at the exterior of the lamp to ignite the gas escaping from the burner, as the flame applied to the exterior end of the pipe is conducted along its interior to the burner. Lamps so arranged can be lighted by a lantern carried on the end of a staff, thus avoiding the use of a ladder and the consequent labour of ascending and descending and carrying it.

This part of the invention also consists in arranging the gas-burner on a swivel joint, so that it can be turned to the side of the lamp or protecting-cover, which is perforated at this point, so that a light can be applied to the exterior of the lamp or protecting-cover to ignite the escaping gas, after which the burner can be turned to its correct position. A gas-governor and stop-tap is combined in a peculiar manner with the last-described method of lighting, so that the swivel movement of the burner answers as well for turning on or shutting off the gas, which is accomplished by fixing the gas-governor on the end of the plug of the tap, having a gas passage in the direction of its axis, the burner being fixed in a pipe leading from the outlet-passage of the gas-governor, so that both the burner and gas-governor swivel with the movement of the tap or plug.

1444.—James Alexander Manning, of the Inner Temple, in the co. of Middlesex, Esquire, for "*An improved mode of intercepting and treating the sewerage of London, and towns and cities similarly situated.*" Provisional protection only obtained. Dated June 26, 1858.

This invention relates to a system or mode of intercepting at the mouths of the several sewers of London the sewerage which is at present discharged into the Thames, whereby the pollution of the same will be entirely avoided. It is obvious that this system is equally applicable to the interception and treatment of the sewerage of other cities and towns in a position similar to that of the metropolis.

In carrying out this invention it is proposed to connect (by a closed tubular drain or pipe) the mouth of each sewer emptying itself into the Thames, to a building erected at low water mark, and containing two tanks of sufficient capacity to receive the flow from such sewer for one or more hours. In cases where two or more small sewers can be conveniently combined they may all be made to discharge into one set of tanks. The several tubular connecting drains or pipes to the depositing-tanks with which they are connected are entirely shut off from all communication with the river. In the lower levels the tanks will be of such an increased depth as to ensure the constant flow of the sewerage, whilst the connecting tubular drains or pipes will be so supported above the surface of the river strand as to prevent any possibility of the tilting of the mud against the sides. The tubular connecting-pipes are made with forked branches, one leading to each of the depositing-tanks; and each of these branches is furnished with a sluice or other stop-valve, so that on one tank being filled the flow of sewerage will be directed to the second tank. During the time occupied by the filling of the second tank, the operation of precipitating all the animal and vegetable organic matters held in suspension in the sewerage contained in the first tank, as well as the deodorization both of the solid and liquid portions of the sewerage and the clarification of the water, together with the discharge of such clarified water into the Thames, are accomplished; such operations being carried on continuously from each tank in rotation, so that at no time is the regular and constant flow of the sewerage impeded or interrupted.

The operation of precipitating, deodorizing, and clarifying the sewerage may be effected in the manner described by the patentee in the specification of his patent for the treatment of sewerage of the 7th of August, 1855, or by any other similar method.

## PROVISIONAL PROTECTION

HAS BEEN GRANTED FOR THE UNDERMENTIONED INVENTIONS.

2696.—John Ramsbottom, of Accrington, Lancaster, engineer, for "*Improvements in machinery or apparatus applicable to water-meters, and to indicating and regulating the flow and pressure of fluids generally, and in obtaining motive power from the same.*" Nov. 27, 1858.

2764.—George Edward Noone, 28, Hodson Street, Francis Street, Newington Butts, London, engineer, for "*Certain improvements in machinery for generating gas from coal.*" Dec. 3, 1858.

2776.—Edouard Aristide Servier, of Paris, engineer, for "*Improvements in pressure and fluid level indicators.*" Dec. 4, 1858.

2811.—Charles de Capot and Alexandre Jarriant, of 10, Route de la Révolte, Neuilly-sur-Seine, France, for "*A new hydraulic counter.*" Dec. 8, 1858.

2820.—John Barrow, Jun., of Manchester, manufacturing chemist, for "*Improvements in the treatment of coal gas tar, and of the oils obtained by the distillation of the same, and for the application of substances obtained thereby.*" Dec. 9, 1858.

2839.—George Ferguson Wilson, of Belmont, Vauxhall, London, for "*Improvements in the manufacture of lubricating oils.*" Dec. 10, 1858.

2843.—Stephen Dudgeon, of Sheffield, for "*An improved gas regulator.*" Dec. 11, 1858.

2861.—David Anderson, of Glasgow, N.B., ironmonger, for "*Improvements in taps and valves.*" Dec. 14, 1858.

2903.—Andrew Peddie How, of Mark Lane, engineer, for "*Improvements in cocks or stop-valves.*" Dec. 18, 1858.

2911.—Alfred Vincent Newton, of 66, Chancery Lane, for "*An improvement in lanterns.*" A communication. Dec. 20, 1858.

# Legal Intelligence.

## COURT OF CHANCERY.

MONDAY, DEC. 20, 1858.

(*Before the* LORD CHANCELLOR.)

SCOTT AND ANOTHER *v.* THE CORPORATION OF LIVERPOOL AND HAWKSLEY.

JUDGMENT.

The Lord Chancellor: This is an appeal from a decree by Vice-Chancellor Stuart, dismissing the plaintiff's bill with costs. The bill was filed for the purpose of obtaining an account of works done by the plaintiffs for the corporation of Liverpool, and of moneys due in respect thereof, under an agreement dated the 6th of November, 1851. The corporation having acquired, under the authority of Acts of Parliament, powers enabling them to supply the borough of Liverpool and its neighbourhood with water, and being desirous of constructing new and additional water-works, caused to be printed and circulated a specification headed "Specification to be observed by the contractor for constructing certain reservoirs and other works to be made in the county of Lancaster for and on behalf of the mayor, aldermen, and burgesses of the borough of Liverpool, being part of the works authorized and required in and by the Liverpool Corporation Water-Works Act, 1847, and the Liverpool Corporation Water-Works Amendment Act, 1850, and the Acts incorporated therewith." The specification referred to and included three proposed contracts, for one of which only the plaintiffs tendered, distinguished as No. 5, and which comprised the formation of a reservoir called the Rivington Reservoir. This contract the plaintiffs undertook to perform for the sum of £56,262. 8s. 8d., and their tender having been accepted by the corporation, the agreement before mentioned was entered into, by which the plaintiffs contracted with the corporation to construct, complete, and deliver up the works comprised in the contract No. 5 for the price aforesaid, and to observe and perform all things mentioned in the specification on their part to be observed and performed. There was annexed to the specification certain general conditions, to some of which it will be necessary particularly to refer, for on the proper construction of them the case entirely depends. In page 33 of the printed specification there is a clause—"and it shall be lawful for the said corporation, in case the contractor shall fail in the due performance of any part of his undertaking, or shall become bankrupt or insolvent, or shall compound with his creditors, or propose any composition to his creditors for

the settlement of their debts, or shall carry on or propose to carry on his business under inspectors on behalf of his creditors, or shall commit any act of bankruptcy, or shall not, in the opinion and according to the determination of the said engineer, exercise such due diligence and make such due progress as would enable the works to be efficiently completed at the time and in the manner aforesaid, to determine the contract by a notice in writing under the hand of the town-clerk, and to enter upon and take possession of the said works, and of the plant, tools, and materials of the contractor, and use or sell, or use and sell, the same as the absolute property of the corporation. The plant, tools, and materials provided by the contractor shall in all cases, from the time at which they or any of them may be brought upon the works and lands of the corporation, and during the construction and until the completion of the works, become and continue the property of the corporation; and the contractor is hereby prohibited from removing the same, or any part thereof, during the progress of the works, without the consent in writing of the engineer; and in case of the contract being so determined as aforesaid, the corporation may relet the undertaking of the contractor, or any part thereof, and upon such conditions as they may think fit, or from time to time, may engage workmen and provide all such materials, implements, and apparatus, and employ the same in such manner as the said engineer and his clerk, assistant, or inspector, or either of them, may think necessary and proper for completing the said works, or any of them, or for repairing and remedying, or endeavouring to repair or remedy, any defects which may appear therein; and when the contract shall have been so terminated, or so soon thereafter as the engineer may think convenient, the engineer shall fix and determine what amount (if any) is then reasonably earned by the contractor in respect to work actually done, and in respect to the value of any materials, implements, and tools provided by the contractor, and taken to by the corporation, and the amount thereof, after allowing for all sums then already paid to the contractor on account, shall remain in the hands of the corporation without interest until twelve months after the date of the engineer's certificate of the final completion of the works as herein provided, and the said engineer shall be at liberty to authorize by his certificate the said corporation to deduct the damages, losses, costs, charges, and expenses in his opinion incurred by them in consequence of the premises, or to which they may be put or be liable, together with the forfeitures (if any) incurred by the said contractor from any sum or sums of money which would so become due and owing to the said contractor; and in case such sum or sums of money shall not be sufficient to defray such damages, losses, costs, charges, expenses, and forfeitures, then the contractor will forthwith pay the deficiency to the corporation, and it shall be lawful for the said corporation to recover the same from the said contractor by action at law, or otherwise." And in page 34—"And the contractor shall be entitled to payment for his work in manner following, that is to say, to a monthly instalment equal to 80 per cent. of the value of the amount of the work executed in the then preceding month; to a further instalment of 10 per cent. of the value of the amount of work executed when such works are completed, delivered to, and accepted by the said corporation in manner aforesaid, and the balance, whatever the same may be found to amount to, so soon as the responsibility of the contractor shall cease and determine, and shall have been entirely fulfilled; provided that no sum or sums of money shall be considered to be due and owing, nor shall the contractor make any claim against, or demand upon, the corporation for or on account of any work executed by him, unless the said engineer shall certify the amount thereof, and that the said contractor is reasonably entitled to such instalment or balance respectively, nor unless such certificate shall have been presented to the town-clerk of the borough, nor shall any such sum or sums of money be considered payable to the contractor until the expiration of seven days after such shall have been so presented, nor shall any omission to pay the amount of such certificate at the time the same shall be payable, be held or deemed to vitiate or avoid the contract." There is, then, in page 35 of the printed specification a very general clause as to submission to reference to arbitration:—"In case of any doubts, disputes, or differences arising or happening, touching or concerning the works, or any of them, or relating to the quantities, qualities, description or manner of work done and executed, or to be done and executed, by the said contractor, or to the quantity or quality of the materials to be employed therein, or in respect to any additions, deductions, alterations, or deviations made in, to, or from the works, or any part of them, or touching or concerning the meaning or intention of this specification, or of any part thereof, or of the contract entered into by and between the corporation and the contractor, or of any plans, drawings, instructions, or directions referred to in this specification on the contract, or which may be furnished or given during the progress of the works, or touching or concerning any certificate, order, or award which may have been made by the said engineer, or in anywise whatsoever relating to the interests of the corporation or of the contractor in the premises, such doubts, disputes, or differences shall from time to time be referred to, and be settled and decided by the said engineer, who shall be competent to enter upon the subject matter of such doubts, disputes, or differences, with or without formal reference or notice to the parties to the contract, or either of them and who shall judge, decide, order, and determine thereon; and to the engineer shall also be referred the settlement of the said contract, and the determination of the sum or sums or balance of money to be paid to or received from the contractor by the corporation, and the directions, decisions, admeasurements, valuations, certificates, orders, and awards of the said engineer (which directions, decisions, admeasurements, valuations, certificates, orders, and awards respectively may be made from time to time) shall be final and binding upon the said corporation and the said contractor respectively, and shall not be set aside, or be attempted to be set aside, by reason or on account of any technical or legal defects therein, or in this specification, or in the contract founded thereon, or on account of any informality, omission, delay, or error of proceedings in or about the same or any of them, or in relation thereto, or on any other ground, or for any other reason, or for any pretence, suggestion, charge or insinuation of fraud, collusion, or confederacy, or otherwise, howsoever." And also that, "if either party shall, in the opinion of the engineer, attempt to do so, or to hinder or delay the engineer from making any certificate, order, or award, it shall be lawful for the said engineer, if he shall see fit so to do, to proceed *ex parte*, and any certificate, order, or award which may be made by him thereafter shall be final, binding, and conclusive on the parties, notwithstanding any attempted revocation by either of them, or otherwise." This contract has been characterized as one of great severity towards the contractors, who are said to be placed by it entirely at the mercy and the arbitrary discretion of the engineer. But arguments drawn from the hard terms of an agreement are never admissible after it has been entered into, because the parties have then deliberately consented to be bound by it. The contractors entered upon the execution of the works. They complained that they did not obtain possession of the land on which the works were to be executed until a long time after the time specified in the contract, and hence that great delay necessarily arose. On the other hand, the engineer of the corporation attributes the slowness of the works to the dilatoriness of the plaintiffs and the insufficiency of the plant and materials employed by them. It is unnecessary to determine where the fault, if any, lay. Mutual dissatisfaction undoubtedly prevailed, which led the corporation to exercise the power they possessed of determining the contract by a notice from the town-clerk, dated the 28th of February, 1855; and that notice states that the contractors having "failed in the due performance of their undertaking, and also, according to the determination of Mr. Thomas Hawksley, the engineer, in the said contract mentioned, have not exercised such due diligence and made such due progress as will enable the works in the said contract mentioned and referred to, to be efficiently completed in the manner by the said contract and specification thereto annexed, provided this council doth determine the said contract and will enter upon and take possession of the works in the said contract referred to, and of the plant, tools, and materials of the said contractors." It is admitted by the plaintiffs that the corporation were entitled to give this notice, and that it legally determined the contract, and therefore the rights of the parties involved in this suit must be ascertained and determined upon as they existed at and from this period. It appears that at the time of the determination of the contract, the corporation had paid to the plaintiffs on account of the works they had done various sums of money amounting to £49,942. 8s. 4d. These payments were made from time to time during the progress of the works, either on certificates or from the reports of the engineer of the amounts that had become payable under the contract. On the determination of the contract, the corporation, in exercise of the powers which they possessed under it, took possession of the works which had been executed by the plaintiffs, and of the plant, tools, and materials which they had brought on the works and lands, and completed all that they had left unfinished. While the contract was subsisting, the plaintiffs were desirous of substituting for the decision of Mr. Hawksley, the engineer, as to the amount payable to them, the arbitration of some other indifferent person, to which the corporation declined to accede. On the determination of the contract, the plaintiffs sent to the corporation a statement of the amount which they claimed to be due to them for the works they had executed; and, the corporation disagreeing to the amount, Mr. Hawksley, on the 19th of March, 1855, appointed Monday, the 26th of March, 1855, to proceed with the reference on such claims, pursuant to the terms of the contract, to which the plaintiffs' solicitors replied by letter of the 22nd of March, 1855, that the corporation having given them notice that they had determined the contract, they apprehended the references under it were at an end also. The notice by Mr. Hawksley was given with an intention of proceeding under the general clause of reference contained in the 35th page of the printed specification; but having been advised that he ought to proceed under clause 33, which applies to the case of the contract having been determined on the 7th of April, 1855, he wrote to the plaintiffs a letter in these terms:—"Gentlemen,—I beg to inform you that I intend to proceed to fix and determine what amount has been reasonably earned by you in respect to work actually done by you under said contract, and in respect to the value of any materials, implements, and tools provided by you, and taken to by the corporation of Liverpool, and request your attendance at my chambers, No. 30, Great George Street, at eleven o'clock in the forenoon of Saturday, the 21st of April, 1855, accordingly, when and where I shall be glad to receive any information or evidence you may think fit to submit for my consideration; and, further, that in the event of omission to attend at the time and place before mentioned, I shall feel it my duty to proceed *ex parte* in the matter aforesaid." To this, the plaintiffs' solicitors replied on the 9th of April, 1855:—"Messrs. Scott and Nowell called on us to-day, after we had forwarded your enclosure by them by post. We read to them the copy you had sent us, and we are instructed in reply to inform you that as the corporation have declined to refer the matters to an indifferent party, our clients, acting under our advice, will immediately file a bill in equity for relief. Under these circumstances, we will decline to attend at your office on the 21st instant for the purposes mentioned in your notice." The bill was filed on the 22nd of November, 1855, the corporation and Mr. Hawksley being made the defendants, the latter being charged with having, "under the direction of the defendants, the corporation, aided and abetted them in withholding from the plaintiffs payment of the moneys justly due to them in respect of the said contract, and the defendants have joined in acts which amount to a *fraud* upon the plaintiffs;" and this is curiously qualified in the remainder of the 22nd paragraph of the bill, thus:—"The plaintiffs do not, however, employ the word '*fraud*' in its offensive or obnoxious sense, as meaning a fraudulent scheme or intention, deliberately formed or entertained for the purpose of cheating the plaintiffs, but as meaning conduct which would be the instrument of fraud, if it should prevail to prevent the plaintiffs from recovering payment of what is justly due to them." And the bill prayed—"That it may be declared that the withholding of the certificates, which the defendant, the engineer, was by the terms of the said specification and contract bound to give to the plaintiffs of the amount remaining due to them for works executed by them under the said contract, was and is a fraud on the plaintiffs, and that the plaintiffs are entitled to receive all such sums of money as they would have been entitled to if such certificates had been duly granted." To this bill Mr. Hawksley demurred, upon the ground that he was improperly made a party to the suit. The Vice-Chancellor overruled the demurrer with costs, being of opinion that the charges in the bill (assumed to be true for the purpose of the demurrer) constituted clear grounds of equitable relief, not only against the corporation, but also against the engineer, in respect of his imputed misconduct. The case then came on for hearing; and his honour desiring to be informed whether the plaintiffs had any remedy at law under the contract, he requested the assistance of one of the common law judges, and the question was argued before him and Mr. Justice Erle, whether, on the terms of the contract and the evidence of the course of conduct of the parties in regard to the execution of the works, the case was one in which, if tried at law, the jury would be directed to find a verdict for the plaintiffs. The learned judge expressed a very clear opinion in the negative, on the ground that every right to payment during the progress of works was conditional in obtaining the engineer's certificate, and after the determination of the contract, upon the engineer's fixing and determining the amount of work done, and valuing the plant and materials, and that unless the plaintiffs could show that these requisites had been complied with, they would fail in an action at law. The Vice-Chancellor subsequently gave his judgment that the plaintiffs were not entitled to relief in equity, and dismissed their bill with costs. The plaintiffs contend that this decree is erroneous, and have urged very strongly in argument before me, that if there is no remedy at law, it follows, of necessity, that there must be a remedy in equity, otherwise, as they say, this monstrous consequence will follow, that a party entitled to large sums of money is utterly remediless. This mode of putting the plaintiffs' case is, however, open to the objection that it begins by begging the whole question. It may possibly be, that eventually the plaintiffs may be entitled to recover a large amount that they may prove to be due, and yet at the time of the commencement of an action, or the institution of a suit in equity, they may have bound themselves by contract in such a

manner that until some preliminary act is done no right of payment accrues. To speak of a party being either legally or equitably entitled, under such circumstances would clearly be incorrect, as the title—which both courts of law and equity deal with in cases of this description—is not an imperfect, but a complete title. The question is, whether the plaintiffs have shown they have a present right to an equitable remedy? In order to determine this question, it will be necessary carefully to consider the mode in which the plaintiffs now shape their case. All idea of founding their claim to relief on fraud is altogether abandoned. All the charges against Mr. Hawksley, whatever their meaning may have been, are withdrawn, and, as to him, the bill has been dismissed with costs; and as a corporation cannot commit fraud except through the instrumentality of an agent, this part of the case failing as to Mr. Hawksley, must consequently fail as to the corporation. The plaintiffs, therefore, are driven to sustain their bill by insisting that (the contract not binding them to submission to Mr. Hawksley's award) the accounts are so complicated, intricate, and voluminous, that they cannot be perfectly dealt with or disposed of by any action at law. This is alleged in the bill; but I do not find any satisfactory proof to support the allegation. At the same time I should always be disposed to regard the jurisdiction of courts of law and equity, with respect to complicated accounts, as so far concurrent, that where the parties have proceeded at law, I should be unwilling to withdraw the case from the court of law, merely because a court of equity could more conveniently dispose of it; and I should not think myself at liberty to refuse the aid of this court, when invoked, because a court of common law could completely settle the whole of the disputed accounts. As Lord Cottenham said in *The North-Eastern Railway Company v. Martin*, 2nd Phillips, page 762,—"It is impossible with precision to lay down rules or establish definitions as to the cases in which it may be proper for this court to exercise this jurisdiction. The infinitely varied transactions of mankind would be found continually to baffle such rules, and to escape from such definitions. It is, therefore, necessary for this court to reserve to itself a large discretion, in the exercise of which due regard must be had not only to the nature of the case, but to the conduct of the parties." And again, in the *Taff Vale Railway Company v. Nixon*, 1st House of Lords Cases, he says: "In questions of this sort, each case must be decided according to the circumstances belonging to it." If it is necessary, in order to maintain a bill for an account, that "it should relate to that which is the subject of mutual acknowledgment," as was held by Vice-Chancellor Turner in *Phillips v. Phillips*, 9th Hare, 473, I have no difficulty in treating the accounts here as mutual, as the price of the work done by the corporation to complete the plaintiffs' unfinished work might be properly treated as so much done for the plaintiffs as would have to be deducted from the entire sum which the plaintiffs would have been entitled to if they had completed the whole of the work, besides the deductions which the corporation would have to make for "damages, losses, costs, charges, expenses, and forfeitures." I do not think, therefore, that the mere fact of the accounts being capable of settlement and adjustment in a court of law, would have prevented the plaintiffs being entitled to an account if there was no other objection in their way. But it appears to me that within the contract itself there exists an invincible impediment to the relief which the plaintiffs claim. It has been already seen that by the terms of the contract the plaintiffs are precluded from all remedy at law until the certificate of the engineer has been obtained, or until he has fixed and determined the sum to which the plaintiffs are entitled for the works which they have done, and the value of the plant and materials which were "taken to" by the corporation. This view of the case at law goes very far towards a similar decision in a court of equity. There is no equitable construction of an agreement distinct from its legal construction. To construe is nothing more than to arrive at the meaning of the parties to an agreement, and this must be the aim and end of all courts which are called upon to enforce any rights created by and growing out of contract. The plaintiffs, however, contend that the stipulations in the agreement referring all matters to the decision of Mr. Hawksley, are not sufficient to oust this court of its jurisdiction, and various authorities have been referred to in support of this argument. It is unnecessary to enter in detail into all the cases on the effect of agreements to refer, or the jurisdiction of courts of law and equity, because they have been, most of them, passed in review by Lord Cranworth in *Scott v. Avery*, and are shown merely to establish this proposition, that if I covenant with A B to do particular acts, and it is also covenanted between us that any question which may arise as to the breach of the covenant should be referred to arbitration, that the latter covenant does not prevent the covenantee from bringing an action; a right of action has accrued, and it would be against the policy of the law to give effect to such an agreement that such a right should not be enforced through the medium of ordinary tribunals. This proposition seems to be established by the class of cases at the head of which is *Thompson v. Charnock;* but it is impossible to pass over altogether the case of *Dimsdale v. Robertson* in Jones and Latouche, both on account of the high authority of the eminent judge by whom it was decided, and because it seems to have been entirely overlooked in the decision of similar cases. There Lord St. Leonards, after the consideration of the authorities on the subject, arrived at a conclusion apparently at variance with them. In the view I have taken of this case, it is unnecessary for me to consider the propriety of his decision; but I cannot forbear the remark, in passing, that the circumstance upon which he relied as giving greater effect to the agreement to refer in the case of *Dimsdale v. Robertson*, namely, the power to make the submission a rule of court, and the legislative provisions in such a case, giving authority to arbitrators to examine witnesses upon oath, hardly appear sufficient to distinguish the case from the others in which these stipulations were not found, as they are mere directions as to the mode in which the reference is to be conducted, or for enabling the parties to give greater efficacy to it by attachment for disobedience, and do not operate until after the case has been withdrawn from the action of the tribunals, which the prior decisions establish the parties could have no power to affect. If, then, there had been nothing in this contract but the general agreement to refer, in the clause in page 35 of the printed specification—"In case of any doubts, disputes, or differences arising or appearing"—I should have thought, on the general authority of the class of cases to which I have referred, that if the plaintiffs were in all other respects entitled to an account, they might have been decreed it, notwithstanding this provision. But I am of opinion that an earlier clause than this meets the circumstances that have arisen, and must decide the rights of the parties in their present position under this contract. I refer, of course, to the clause in page 33, which provides for the case of the contract being determined. On the construction of this clause, the question arises whether the principle upon which *Scott v. Avery* was decided does not here intervene and render that case a binding authority upon my judgment. That principle is stated by Lord Cranworth in these terms:—"If I covenant with A B that if I do or omit to do a certain act, then I will pay to him such a sum as I S shall award, as to the amount of damage sustained by him, then until I S has made his award, and I have omitted to pay the sum awarded, my covenant has not been broken, and no right of action has arisen." And I may ask with him, as the question to be answered in this case, Does any right of action exist in this case until the amount of damage has been ascertained in the specified mode? In order to determine this question, we must refer again to the clause in the specification upon which it depends. It is: "And in case of the contract being so determined as aforesaid, the corporation may relet the undertaking of the contractor, or any part thereof, and when the contract shall have been so terminated, or so soon thereafter as the engineer may think convenient, the said engineer shall fix and determine what amount (if any) is then reasonably earned by the contractor in respect to work actually done, and in respect to the value of any materials, implements, and tools provided by the contractor and taken by the corporation." Now, suppose the contractors had chosen to agree that they would be paid for their work—not a specific sum, nor upon measure and value, but such an amount as the company's engineer might fix—can there be a doubt that such a contract, although a very imprudent one, would be binding, and that the contractor would be bound to submit entirely to the discretion, or even to the caprice, of the person whom he had clothed with this arbitrary authority? What is there more in this case? The contractors agree that, in a given event—namely, the determination of the contract by the corporation—the engineer is to fix and determine what amount, if any, is then reasonably earned by the contractor in respect of the work actually done, and in respect of the value of any materials, implements, and tools provided by the contractor, and taken to by the corporation. The plaintiffs' counsel agreed (though this was with reference to the general clause of the reference to the engineer) that, if he had made an award even *ex parte*, the contractor would have been bound by it. I cannot, however, understand how this should be if contractors are not tied by their contract to the judgment of the engineer—if they refuse to appear before him, or in any way to recognize his right to determine the matter. But I think they would be bound by the engineer's decision under such circumstances, because they had agreed to submit to it; and, having done so, how is it possible for them to say that they are entitled to be paid for their work and for their plant, not the amount which the engineer shall fix and determine, but what some other forum may think that they ought to receive? It was stated that this clause leaves the contractors wholly at the mercy of the engineer, who is only to fix and determine the amount which they are to receive when the contract should have been terminated, or as soon thereafter as the engineer may think convenient; and it was argued that he might consult his own supposed convenience and indefinitely postpone his determination. I do not think that the proper construction of these words is, that they relate to the personal convenience of the contractor; but, be that as it may, if he were to decline to enter upon the question, or by any affected delay, or any improper procedure of any kind, were to attempt to delay a decision, a court of equity would know how to deal with such a state of things, though a court of common law might be powerless to afford any redress. The plaintiffs' counsel, however, insist that there are authorities not affected by *Scott v. Avery*, which have determined that in cases very similar to the present parties have been held to be entitled to an account notwithstanding there were equally stringent clauses in their agreements binding them to refer their disputes to arbitration. It will be necessary, therefore, shortly to examine these cases. That which was principally relied upon was the case of *M'Intosh v. the Great Western Railway Company*. In the earlier stage of that case it has no bearing on the present question. The plaintiff, who was a contractor, agreed to do certain works for the company, and the company agreed to advance money on account of works done and executed, such execution to be certified by Mr. Brunel or the principal engineer for the time being. The bill alleged that Mr. Brunel had refused to certify, and that in doing so he was acting in collusion with the company; and it prayed a declaration by the court that the withholding such certificates was a fraud, and that he was entitled to recover the amount. To this bill the defendants demurred, and the Vice-Chancellor Knight Bruce first, and afterwards Lord Cottingham on appeal, decided that the allegation of collusion was sufficient to sustain the bill; and the demurrer was overruled with costs, just in the same manner as the Vice-Chancellor overruled Mr. Hawksley's demurrer in the present case, although on the hearing the charges of fraud could not be established. But the case of *M'Intosh v. the Great Western Railway Company*, which was exactly similar to the former case between the same parties, came on for hearing before Vice-Chancellor Stuart, and it was so alike, it is said, that his honour arriving at a conclusion inconsistent with his decision in this case, decreed an account. To ascertain whether the two decrees are thus inconsistent, it must be seen whether the contract in that case is in terms like the present. It is not given in the report, 3rd Smale and Giffard; but I have been furnished with a copy by one of the learned counsel in the case, from which it appears that the provisions for determining the claim of the contractor were very different from those in the present agreement, there being a stipulation for a general reference of disputes to arbitrators to be named in these general terms:—"But if any difference of opinion shall arise between the company or their engineer and the plaintiffs as to any matter of charge or account as between the company and the plaintiff, such dispute shall be referred and finally settled and concluded by the arbitration of the engineer on the part of the company, and an engineer to be appointed by plaintiff on his part; and in case of their not being able to agree, a third person shall be named in writing as arbitrator by such two engineers before they proceed upon the subject of the reference, and the decision of any such arbitrator so named shall be final and binding on both parties." This clause, in itself, would distinguish the case from *Scott v. Avery*, and would bring it within the class of cases that follow *Thompson v. Charnock*. I therefore think his honour cannot be fairly charged with inconsistency in his decrees in that case and the present. The case of *Ranger v. the Great Western Railway Company*, in which such an elaborate and able judgment was given by Lord Cranworth, appears to me not to assist the plaintiffs' arguments. The contract there made the engineer during the progress of the works the absolute judge of the mode in which the contractor was discharging his duties, and of how much of the contract price had from time to time become payable, and his decision was to be final; but, unlike the present case, after all the works should have been completed, the contractor was to be at liberty to call in a referee of his own as to any question of amount due beyond what had been certified. The contractor was unsuccessful in his suit on every point but one. Upon that one the plaintiffs' counsel have relied as entitling them at least to an account of the value of the plant, tools, and materials taken to by the corporation. But it appears to me that the account decreed in that case is no authority for a similar one in the present. There, as here, the company was empowered to take possession of the work, and of the whole or of such part of the materials, tools, and implements used by the contractor as the company's engineer might consider requisite for carrying on the work. The question was, whether, upon their taking possession, the plant and materials became the absolute property of the company? It appeared there was a clause in the contract, that if the moneys, tools, and materials so to become the property of the company should be insufficient to cover all the charges occasioned by completing the works, then the contractor was to make good the deficiency; and the House of Lords (adopting this view

of the agreement as stated by Lord Cranworth, that the true meaning of it was, that the company, though at liberty to seize and appropriate the plant belonging to the contractor, were yet bound to account for its value in settling their accounts with him) decided that the contractor was entitled to an account of the value of the plant, and also of other matters necessarily connected with and incidental to that inquiry. The agreement as to the plant is very different in this case; for, although it is to become the absolute property of the corporation upon their taking possession of it, instead of the value being applicable to make good any liability of the contractor, it is merely to be fixed and determined by the engineer. So that, if an account were to be decreed to be taken of its value, it would be an entire departure from the contract, by which that question is agreed to be left exclusively to Mr. Hawksley. It only remains to notice the recent case of *Kemp v. Rose*, before Vice-Chancellor Stuart, which is also stated to be inconsistent with the present case. It will be found, however, that his honour admitted that if the question had there depended on the contract alone, the contractor was completely at the mercy of the architect; but he fastened on circumstances which he considered might produce an improper bias upon the architect's mind, and on that ground alone his honour put the contract aside, and opened the way to the jurisdiction of the court in that case. The case of *Kemp v. Rose* is not at variance with his honour's decision in this case. I have entered at so much length into the case, partly on account of its great importance, but principally with a desire to show that there may be extracted from previous decisions principles that may be safely applied to determine the effect of the provisions which are now so common in contracts for the execution of works, by which the contractor's claims and liabilities are placed at the discretion, and under the control and judgment, of the agent of the parties for whom the work is to be done. If the parties to the agreement have provided beforehand for the settlement of any disputes that may arise on the rights and liabilities growing out of the contract, by the arbitration of persons mentioned in the agreement, or to be terminated when disputes arise, such a stipulation cannot be urged as an answer to either party who prefers to resort to the courts for the determination of his rights, nor can it deprive the tribunals of the country of their jurisdiction, whatever remedy may be open to the parties against whom proceedings are instituted for the breach of the agreement. But where the contract provides for the determination of the claims and liabilities themselves of the contractors by the judgment of some particular person, this would be incorrectly called a provision for submission to arbitration, as no dispute can exist in such a case, everything being dependent upon the decision of the individual named; and, until he has spoken, no right can arise which can be enforced either at law or in equity. I think that Mr. Hawksley stands in this relation to the plaintiffs in this case. They have agreed to submit themselves entirely to his judgment, but now decline his authority. If the court were to assume the jurisdiction which is prayed, it would not be enforcing the contract of the parties, but acting in direct opposition to it. I think, therefore, that the decree of the Vice-Chancellor must be affirmed, and the appeal be dismissed with costs.

## VICE-CHANCELLOR'S COURT.

FRIDAY, NOV. 19.

(*Before Vice-Chancellor Sir* W. P. WOOD.)

### BARONESS WINDSOR *v.* THE CARDIFF WATER-WORKS COMPANY.

This was a motion for an injunction to restrain the defendants, the company, "from maintaining, or continuing, or allowing to remain in, upon, or under the piece of land in the bill mentioned, situate near Ely Bridge, any pipe or other work other than the pipe originally laid therein, or a new and similar pipe in the place and stead thereof;" or from placing any pipe or other work in, upon, through, or under any of the lands devised by the will of the late Earl of Plymouth, for the purpose of conveying water to Penarth, or any other place than the town and port of Cardiff, and the parishes within and adjoining such town in the county of Glamorgan.

Mr. ROLT (with whom was Mr. FREELING) appeared for the plaintiff, and in opening the case stated that the company, instead of constructing their works according to the deposited plans, constructed them in another direction, got to Cardiff by going down the river Ely, and in doing that, their pipes had to be laid on a portion of the land belonging to the plaintiff. The plaintiff's land adjoined the river Ely, and of course she was entitled to half the bed and soil of the river; and without any permission whatever from the plaintiff or her agents the company laid down their pipes. The plaintiff did not seek to disturb the company in what they had done, but wished to restrain them from putting down any additional pipes. The company seemed to think that because the plaintiff did not interfere with them before, that she was estopped from doing so now on the ground of acquiescence. The defence, in short, was, that because the plaintiff did not object to their laying pipe No. 1, therefore she was bound to acquiesce in their laying pipe No. 2. By their Act of Parliament, the company had no power to lay down additional pipes where they had laid one, though they might substitute a new pipe for an old one when it was worn out; and upon this ground the plaintiff asked for the injunction. In addition to this, the plaintiff contended that the powers of the company were expressly limited to supplying the town and port of Cardiff with water, whereas what they were now doing was for the purpose of supplying Penarth, and this would have the effect of depreciating the plaintiff's property. In answer to this objection the defendants suggested that Penarth was within the port of Cardiff, and therefore they had authority for doing that which the plaintiff objected to. The defendants also suggested that there had been delay on the part of the plaintiff; but the fact was, that the moment it came to the knowledge of the plaintiff she interfered. An *interim* order was obtained, and notice of the awarding of the injunction was served in Cardiff on the secretary of the company when there was a day's work remaining to be done. He put the notice in his pocket, went to Bristol, leaving the orders previously given uncontradicted, and the excuse he made was that he went to see his directors. The court would, no doubt, tell that gentleman that it was his imperative duty, before he did anything else, to stop the work at once, and that, by not doing so, he had been guilty of a breach of the injunction, and hold that the plaintiff was entitled to the relief which she asked.

Mr. WILLCOCK and Mr. HOBHOUSE appeared for the company.

The VICE-CHANCELLOR: Mr. Willcock, my present impression is, that the proper mode of dealing with this case is to let the motion stand till the hearing of the cause, with liberty to the plaintiff to take any proceedings at law she may think fit.

Mr. WILLCOCK: It is not worth my while to contend against that, sir.

The VICE-CHANCELLOR: What seems to me to be the proper course to take is independent of any question of acquiescence. The injury complained of is the laying certain pipes through closes belonging to the plaintiff. Well, that obviously is an ordinary case of trespass, and, if it were not the case of a company, it would be impossible for this court in any way to afford assistance or relief.

Mr. WILLCOCK: The question will of course have to be discussed at the hearing of the cause.

The VICE-CHANCELLOR: Yes; that is what I say. The motion will stand over till the hearing. With regard to mere cases of trespass, where no irreparable damage is done, it is not the habit of this court to afford any relief; but with regard to all cases in which public companies, in the exercise of the large powers that the Legislature has conferred upon them, endeavour to overstep their rights, however trifling the interest in one sense, provided there is pecuniary damage (I must lay down that proposition with reference to the case I mentioned the other day of Holyoake and the Shrewsbury and Chester Railway Company), and although it be a trespass to be compensated by sufficient ordinary damages, yet still, regard being had to the great power the Legislature has entrusted to these companies, over the rights of third persons the court has taken upon itself to hold those companies within due bounds, and has interfered at once by injunction when the wrong is clearly made out, or where it is so sufficiently made out as to justify the court in interfering on an interlocutory application. But in this particular case now before me, the company rely in their evidence upon what they consider to be a right conceded to them on the part of the plaintiff. It is not necessary for me to enter very minutely into that question, and I think (and I do not think that the learned counsel for the defendants would object to my so stating the proposition) that if we were now at the hearing of the cause, the evidence of that right is not in a complete position. They have made certain entries in their books which would point to certain conclusions, but at present they are not fortified by any cogent evidence. The company have not come here however under their Act of Parliament, saying, "We have a right, by the powers conferred upon us by this Act, compulsorily to pass through your land;" but they come here under an averment of some original agreement with Mr. Clive, the then owner of the property, through whom the plaintiff now claims, authorizing them to do certain acts to the extent they were then done; and they say further than that, "We have arranged and settled with your tenant, who is the present occupier. We have paid him with reference to the leave which was given to pass through the land; and we have not done this behind your backs, but with your knowledge—you standing by and allowing our pipes to be laid down in your land." That relates to the immediate wrong and the trespass committed. Well, in that state of things it appears plain that the plaintiff has a remedy. It is reduced to the ordinary case of a trespass committed, in which case this court will not certainly interfere by way of summary remedy. But there is no doubt one reason (and I ought to state that) why I reserve the case till the hearing. Possibly, when the case comes to a hearing, there may be questions as to breaches of the peace, or the like; some difficulties may have occurred in asserting the right; there may be some verdict obtained in an action which the plaintiff may be advised to bring; or something may have occurred which may call for the interference of the court with a view to prevent further mischief. I say this without regard to what has passed with reference to acquiescence. As to acquiescence, what weighs upon my mind is this: I should have had a considerable inclination to refuse this motion at once with costs, in consequence of all the matters within the knowledge of the parties not having been stated on the motion for the injunction; for I unquestionably think that Mr. Goddard, the gentleman who made the affidavit, and who had within his own breast a knowledge of all the facts, ought to have stated all he knew of the previous arrangements. I do not, in the least, mean to intimate an opinion on the facts stated, but equitable rights may at all events come into question with regard to the degree of acquiescence the plaintiff's agents may have shown; and Mr. Goddard, instead of merely representing to me, as he does in his affidavit, that on the 16th of October he knew first that the pipes were being laid down, ought not to have contented himself with making that bare statement, but ought also to have stated that as early as the 16th of September application had been made to him for leave to lay the pipes down; that he had entered into communication with the secretary; that there had been a correspondence upon the subject; and that he had not answered the secretary's last letter, which might fairly lead the secretary to suppose that no objection was about to be raised to what was being done. It is said there was some misrepresentation on the subject; but at all events I ought to have been informed of all the facts before I was asked to grant an injunction. What occurred afterwards was that a contest being raised by a Mr. Cartwright about the right to a portion of the land through which the pipes were to pass, the works were all stopped through the intervention of Cartwright until Goddard came forward and said—"Do not mind Cartwright at all. I have not the least objection to make. Deal with me, and not with Cartwright." It is said you ought not to attend to what local solicitors or land agents say; and that may possibly be true in some cases, but at the same time, with regard to a permission of this description—the passage of a water-pipe—it does seem to me a strong proposition to say that people are not to be satisfied with the answers given by land agents and local solicitors, but must endeavour to go beyond there; that, although they suppose them to be persons competent to treat, they must seek out the employers of the persons who fill those capacities before they take any step whatever, and are to be prevented by injunction if they take any step with the acquiescence and concurrence of a person who represents a land agent or solicitor to the owner of the property. To say that you are entitled to come to the court and apply for an *interim* order behind the back of the parties, without letting the court know all that has taken place, is to assert a proposition which is contrary to all the practice of the court; and I felt very much inclined upon that point to dispose of this action at once with costs, but there was an unfortunate set-off rather with reference to the manner in which the court has been dealt with, which leads me not to part with the case without saying I am not satisfied. I will say no more without hearing counsel on the other side: but I am not satisfied with the secretary of the company receiving an intimation of the *interim* order of this court, and putting the order in his pocket while the work is going on.

Mr. WILLCOCK: He stated that he had no authority, and referred them to a person who had authority.

The VICE-CHANCELLOR: I think it was his duty to communicate it to the workmen. If he had done so, he would have relieved his own conscience; and if they had chosen still to go on, it would have been at their own peril.

Mr. HOBHOUSE: It is stated that the works were in such a state that, if they had been stopped, and a flood had come down, very great injury would have been done, and the supply of water to the town of Cardiff would have been stopped.

The VICE-CHANCELLOR: That was on the next day. I observe it is stated that the works had got to the banks of the river on the previous

evening, and at two o'clock the next day the works were still going on with this gentleman having the notice in his pocket all the time.

Mr. WILLCOCK: I do not wish to enter into any controversy upon this subject now, sir, but it was in the hands of the contractor, and he had previously stated to Mr. Goddard that he had no authority.

The VICE-CHANCELLOR: However, I could not pass unnoticed such a course of proceeding as that on the part of this gentleman, and allow it to be supposed that the court sanctioned any such proceedings. The proper order to make will be to let the motion stand till the hearing of the cause, with liberty to the plaintiff to take any course she may be advised at law.

TUESDAY, DEC. 21, 1858.

THE PENARTH HARBOUR COMPANY *v.* THE CARDIFF WATER-WORKS COMPANY.

Mr. ROLT: The plaintiffs in this case seek to restrain the defendants from taking water from the Ely, as we say, beyond their powers, and seriously to our detriment. The detriment is of this character: We say that the result of their taking the water will be that there will not be sufficient water in the river Ely, and that it will silt up; and that the damage done would be of so serious a character as to be irremediable.

Mr. WILCOCK: There are two questions: one is, whether they have any right at all to the water; and the other is, whether, that being so, our title under Acts of Parliament is not paramount to theirs. No doubt the object is to prevent our putting down a second pipe, the same as in the case of *The Baroness Windsor v. The Cardiff Water-Works*. A pipe is laid down, the water flows from the river to the reservoir at this moment, and supplies Cardiff; and it has travelled a certain way towards Penarth. They have come long after the works have been done.

Mr. ROLT: The undertaking that I should ask would be, that we should be in the same position as if we were now at the hearing, and let the matter stand over. But as to anything that may be done in future, that will stand in a different position.

Mr. WILCOCK: I must decline to give that undertaking, because it embarrasses the argument. We have laid out a great deal of money, and begun the works in 1856.

Mr. ROLT: I think the right thing will be to turn the motion into the hearing of the cause.

Mr. WILCOCK: We will put in our answer as quickly as possible. I believe it is the object of both parties to bring the matter to as speedy an issue as we can, in order to have the opinion of the court. It will, therefore, be more an understanding than anything else that each party should use due diligence for the purpose of bringing the matter before the court in order to have its decision but once.

Mr. ROLT: Then we will so take it.

The VICE-CHANCELLOR: Very well.

## GREENWICH POLICE COURT.

TUESDAY, DEC. 14, 1858.

CHARGE OF STEALING GAS.

*John Knapp*, a butcher, carrying on business at Russell Street, Rotherhithe, was summoned before Mr. SECKER by the Surrey Consumers' Gas Company, under the following circumstances:—

Mr. JOSEPH SOLOMON, who appeared for the company, stated they had adopted the mild form of proceeding by summons against Mr. Knapp, but the charge really was for stealing a quantity of gas, the property of the company. The defendant had been their customer for some time, but failed in his payments, and the meter was consequently taken away, and subsequently the gas was found to be burning, as detailed in evidence.

Mr. *James M'Glashan*: I am an inspector of the Surrey Gas Company. On the 8th of December I went to Knapp's house. I asked for £1. 5s. 3d. for the current quarter's gas. I was not paid. I did not see the defendant then. As I was not paid I brought the meter away with me. It was in the shop. I went there again on Tuesday, the 14th, at about twenty minutes past four. The gas was then burning in the shop. I looked if a meter had been placed there, but saw none. There was a connexion made by a piece of pipe wrapped round with a greased rag to the service-pipe from the main. All the pipe beyond the meter belongs to the consumer, but we carry the pipe up to the meter from the main. The consumer's pipe is movable to a certain extent. I saw the connexion was made by a piece of pipe being shoved into the service, and had not any appearance of being done by a workman. The meter was taken, and the gas cut off in the usual way. When we take the meter away we do not cut off the gas from the main, trusting to the honour of the customer. I put a tap on when I cut off the gas, and when I went there on the 14th of December I found that tap taken off, and the consumer's pipe fitted in. That connexion was made without the authority of the company. I repeatedly applied to the defendant for payment of his gas bill. We generally give a week or ten days' notice that we are going to cut off the gas if the money is not paid. There is not any written or printed contract between the company and the consumer.

Cross-examined by *Knapp*: Your servant has never called at our office with the money. On Friday last, after this summons was taken out, you came to the office and offered me £2, about four o'clock in the afternoon. He said he came for the purpose of paying the quarter's gas that had been applied for.

Mr. SECKER: I suppose the defendant will say he burns gas under a contract, and, as he requires it there for the purposes of his business, he would not agree to the rescinding of that contract?

Mr. SOLOMON: We say there is no contract, and the Act gives us summary power.

Mr. *C. Schomberg*: I am the chief inspector of the company. I went with the foreman to Mr. Knapp's, about five o'clock on Wednesday last. The gas was then burning. I did not inspect to see if there was a meter. I went the next morning at six o'clock, and saw the gas alight at three burners. I did not see Knapp; his wife told me he had just gone out. I then inspected the premises, and found there was no meter. If the gas had passed through a meter at all I must have seen it. I looked where the meter would have been, and found there was not one there. I looked where the meter stood. It stood under the shop-board, close to the window. I then had the gas cut off in the road, by leave of the parish authorities.

*Henry Cawsay* accompanied the last witness, and fully corroborated his evidence.

The case was then adjourned till the next day (Wednesday), when a clerk proved that he sent a notice on the 4th to the defendant, that the gas would be cut off if the money due was not paid by the 7th.

The accused person, who had been in "durance vile" all night, was then committed to take his trial at the next Surrey Sessions, but allowed to be at large on bail.

[We purposely abstain from any report of the defendant's violent conduct and language before the magistrate and in the cell of the station.]

WEDNESDAY, DEC. 29.

EMBEZZLEMENT BY A GAS COMPANY'S COLLECTOR.

*John Hunt*, a respectable-looking man, 59 years of age, was brought before Mr. SECKER, charged with embezzling various sums of money received for and on account of his employers, the Surrey Consumers' Gas Company.

The prisoner, it appeared, had been for some considerable time in the employ of the company as collector and inspector, but on Wednesday, the 22nd ult., he suddenly absented himself from his duties. An investigation then took place, and it was ascertained that several sums of money received by him from gas consumers had not been paid over by him, as was his duty, to the bankers, to the account of Mr. Croll, the lessee of the company's works. Information was accordingly given to the police, and on Tuesday evening detective-officer Knight, of the City police, apprehended the prisoner.

Mr. *Schomberg*, the chief inspector to the company, deposed to three sums, amounting to £24. 9s. 6d., received by the prisoner and not accounted for, and added that the prisoner's deficiencies were expected to amount to upwards of £120.

The prisoner, who said he had nothing to say in answer to the charge, was remanded until Thursday, the 6th of January.

# Miscellaneous News.

## MR. FLINTOFF'S REAPPEARANCE IN DUBLIN.

A meeting was held in one of the large rooms of the Rotundo on Wednesday the 22nd ult., to take into consideration the present price of gas, and the reduction proposed to be effected through the instrumentality of a new company, the "Dublin Independent Consumers' Company," stated to be in process of organization.

The meeting was called for one o'clock, but at twenty minutes to two the proceedings had not commenced, and those present having manifested their impatience, Mr. FLINTOFF said that in consequence of the inclemency of the weather it had been deemed expedient not to begin for a short time, but Mr. Grogan had authorized him to state that the chair would be taken within the next five minutes.

At a quarter to two o'clock precisely, Mr. EDWARD GROGAN, M.P., entered the room, amidst applause, and on the motion of Mr. Hull Ingram at once mounted the platform and took the chair.

Amongst those on the platform were—Alderman Lambert, Lord Mayor elect; Messrs. Hull Ingram, P. Dixon Hardy, George Magill, James Plunkett, T.C., J. Parker, Martin Burke, T.C., Neville Parry, J. Martin, T.C., J. Bessonett, Q.C., J. Porter, J. Richardson, J. Ireland, Thomas Hall, J. Robinson, William Graham, L. Delany, J. J. Byrne, P. O'Loughlen, Henry Rosenthal, Charles J. M'Dermott, Bond Cox, barrister, H. Courtney, J. Brown, Edward Hely, jun., Michael C. Clarke.

The CHAIRMAN said before the immediate business of the meeting was proceeded with, he might be permitted to make a few observations. A short time ago a most respected citizen waited upon him on behalf of the gentlemen who were interested in promoting a new gas company in the city, and intimated that it was their wish that a deputation should wait upon him to request that he would take the chair at a public meeting, with a view of enabling them to lay before their fellow-citizens the propositions by which they expected to save the city a very considerable sum indeed. (Applause.) It was now several years since, through the partiality of his many friends, he had the honour of being one of their representatives, and as such, he, of course, found it his duty in any question affecting the interests, the comfort, the convenience, and economy of his fellow-citizens to co-operate with any company, or with any other body, who were desirous of submitting propositions capable of ensuring these advantages. (Applause.) Moreover, when he ceased to enjoy the honour and privilege of their representation, he hoped to be, as previously, a citizen of Dublin; and, therefore, any question taken up by the gentlemen who, if they were in a position to establish their propositions, would be able to effect a reduction of £40,000 a year in the lighting of the city, deserved at his hands, and he was sure at those of the meeting, the fairest consideration, in order to see how far they were capable of realizing these beneficial results. A matter worthy of being attentively considered at the present moment was, that in a few years to come the present contracts for lighting the streets would expire, and it would be the interest of every one, whether banker, merchant, warehouseman, or private citizen, to have the city well and effectively lighted. If the gentlemen who had called that meeting together should be enabled to give a pure, good, and economical light at a very great reduction in price, which they felt sanguine of being able to effect, this was a question which came home to every one, and in which they were all interested. It was for the purpose of receiving their propositions, and of seeing how far they would display their ability to carry them into practical effect, that they were assembled on that occasion. He would only further suggest, that as the days were very short, and they had a great deal to do, he hoped the meeting would co-operate with him, and that, upon a subject of so much interest and importance to the citizens of Dublin, their proceedings would be conducted in a peaceable, orderly, and temperate manner. (Applause.)

Mr. GEORGE FLINTOFF, the secretary to the Dublin Independent Gas Consumers' Company, then came forward, and said it was his duty to state the object with which they had met together, what it was proposed to do, how it was to be done, and what had already been effected in connexion with taking necessary steps to light the city of Dublin with gas at a cost of 3s. 6d. per 1000 cubic feet. (Applause.) About two years ago he had the honour of appearing at one of the largest public meetings ever held in Dublin to take steps for securing cheap gas. On that occasion, although supported by men of talent, integrity, and worth, he felt that the cause he appeared to advocate was wanting, because of the absence of any effectual remedy for the grievance then existing. He now no longer appeared before the citizens of Dublin to ask for cheap gas without being able to point out a remedy. Since that time the public mind had been influenced to a considerable extent by the facts and figures placed before them at various times. A company had been formed, and he was there to ask them to support that company, in order to get a reduction in the price of gas from 5s. to 3s. 6d. per 1000 cubic feet, as well as the abolition of the meter-rent, and the increase of the illuminating power from 10 to 14 candles. (Hear.) The question was purely a business one. As a matter of course, opposition was to be expected from existing interests, whose property would be depreciated by a new company; but the citizens of Dublin had a right to the benefits resulting from the improvements in science which had taken place since the formation of the existing companies, and if that could be done without injury to themselves, no reasonable man could object to it. (Hear, hear.) The new company, under the Limited Liability Act, propose to raise in £5 shares as much money as would enable them to supply the whole city, and they said they could do so by an expenditure of less than £100,000. The two existing companies had expended £450,000 in the erection of gas-works, and if they could get 7½ or 8 per cent. on such an expenditure, the new com-

pany, taking advantage of the scientific improvements, could supply gas at a cheaper rate, and obtain a better dividend, than the existing companies. In forming such a company, it was necessary for the promoters to come before a meeting like the present for the purpose of enlisting the sympathies of the public, and to prevent it from becoming a sham by an amalgamation with any of the existing companies. (Applause.) If the new company was driven out of the field to-morrow, the existing companies would at once raise the price of gas. When the movement was started, the two companies reduced the price of gas from 5s. 10d. to 5s. per 1000 cubic feet; they promised a reduction to 4s. 9d., but the public never would have got a reduction at all but for the present agitation. By pressing the matter still further, they would get a reduction to 3s. 6d., which would save the city £40,000 a year. That calculation was based as follows:—The present rental for gas was estimated at £80,000 or £90,000 per annum; the public lights cost £11,200 a year; the parliamentary standard for light from the public lamps was equal to 10 candles, so that was at the rate of 6d. per 1000 per candle. The new company proposed to supply 14-candle gas at 3s. 6d. per 1000, so that the public would get as much light for 3d. as the present companies give for 6d. (Hear, hear.) Presuming that the total rental for gas was £80,000, the saving would thus be £40,000 a year to the city. By cheapening the gas and extending the mains, the new company would be able to supply the poorer classes, who had never yet had adequate light with gas, for 3d. or 4d. per week. The existing companies said that the new company could not go on without an Act of Parliament, and that it was "a sham." It was not a sham. When it was first called into existence he was asked to take the management of it, but before they would have a word to say to him he had to give a bond in £3000 to carry out his engagement for five years, if required, in order that the existing companies could not have an opportunity of saying that the object was only to kick up a row, and then sell out and make some money. From the first registration of the company, men of respectability and capital had been connected with it. The estimate of the new company for the supply of gas had been confirmed by three most eminent men—namely, Mr. Samuel Clegg, gas engineer, of London; Mr. T. A. Hedley, gas engineer, of Banbury; and Sir John Macneill, of Dundalk. These gentlemen had given it as their opinion that gas could be supplied at 3s. 6d. per 1000 cubic feet, and securing a good dividend. The new company had actually received a tender to supply gas at the consumers' burners by a person who would manufacture the gas at his own cost, freeing the company from all expenses, at the rate of 1s. 9½d. per 1000 cubic feet. Mr. Flintoff then read the following communication:—

*To the Chairman and Directors of the Dublin Independent Gas Consumers' Company.*

Gentlemen,—I have examined your printed estimates, and am willing to erect the whole of the works and lay all the mains at the prices therein specified; and if you accept my tender, I will undertake to invest one-fifth of the amount of the tender in shares in your company. I have also considered the cost of manufacturing and supplying gas in the city of Dublin; and when the works are completed I am prepared, and I hereby tender, to deliver all the gas you may require at the consumers' burners, free of all extra charges whatsoever, at 1s. 9½d. per 1000 cubic feet. I believe that this price is paid to the contractor by the new gas company in London, and, according to my calculation, a profit of 1s. per 1000 feet in the price of my tender will pay 10 per cent. per annum to your shareholders, while the entire cost of gas to the company will be only 2s. 9½d. per 1000 feet, being 8½d. per 1000 feet less than the price at which you undertake to supply gas to the citizens of Dublin.—I am, Gentlemen, your obedient servant, JACOB ROBINSON, contractor,
*December* 17, 1858. Dublin and Hull.
P.S.—I intend to be present at your meeting on Wednesday next. J. R.

Mr. Flintoff next read a letter which had been received from Sir J. Macneill, expressing regret that he had not been able to complete his report in time for the meeting, but stating that, so far as he could judge, there was no reason why an adequate supply of gas, at 3s. 6d. per 1000 cubic feet, could not be provided for the city of Dublin. The statement made by the present companies, that the new company could not open the public streets, was altogether unfounded, and in proof of this he read the following letter from Mr. Nagle, the solicitor of the new Cork Gas Company:—

35, *Lower Dominick Street, Dublin, Dec.* 14, 1858.

Sir,—In reply to your letter of yesterday's date, requesting information for the directors of your company with regard to the legal position of the Cork Gas Consumers' Company, and on other points connected with the gas question in that city, I beg to state as follows:—First, The Cork Gas Consumers' Company have no special Act of Parliament; they have opened the streets and lighted the city under the authority of a contract from the corporation, executed by that body in pursuance of the Local Act of 1852, which renders applicable to the lighting contracts of the corporation the provisions of the General Gas Clauses Act. Second, The United General (in Dublin the Hibernian) Company supply gas to private consumers in Cork at 2s. 6d. per 1000 feet, free of meter-rent. Before the starting of the new company (which charges 4s. 6d. per 1000 feet, free of meter-rent), the United General charged 6s. 8d. per 1000 feet, with meter-rent, which made the price 7s. Third, The Consumers' Company in Cork estimated the meters for the first year at 900; they now (at the end of that year) have over 1500 meters. The agents of the opposing company assert that they also have a good trade; and it is obvious, therefore, that (to quote your words) a reduction in the prices has caused the consumption of gas to increase in Cork.—I remain, Sir, very obediently yours,
(Signed) DAVID A. NAGLE.

The corporation of Dublin, if applied to, could give a similar authority. The case of Sheffield, referred to by the existing companies to show that the streets could not be opened, was not analogous, for the streets there were not vested in the corporation as in this city. The Dublin corporation would not refuse to give their sanction to a proceeding that would save £2000 a year in direct taxation, and would save the consumers £40,000 a year; at least, were they to do so, it would be a most improper proceeding. Instead of taking days to open the streets, and choking up the thoroughfares, so as to give an idea that gas-work was the most difficult thing in the world, it was proposed by the new company that all the pipes should be laid under the flagways. That work could be all performed in seventy or eighty nights, and with such expedition that a merchant leaving his office at five o'clock one evening, and returning to it at ten the next morning, would see nothing to induce him to suppose that the gas-pipes had been laid before his door in the meantime. ("Hear," and applause.) But cheapness in the price of gas would not be the only advantage that would result from the working of the new company. There were 6000 gas-meters in use in Dublin susceptible of registering from 15 to 33 per cent. more gas than was actually consumed. At the request of Mr. Vance, M.P., it was his intention to give a public scientific lecture proving that fact. (Applause.) The cost of gas to the consumers was regulated by two or three matters. First, the outlay of capital in forming the company, and in erecting the works, laying the pipes, &c. It would require 1s. per 1000 cubic feet profit to pay a dividend on the capital of the new company, whereas the Alliance Company would require 1s. 9d., and the Hibernian Company 3s. 3d. per 1000 to pay the same dividend. It was clear that, having such an immense amount of capital, the existing companies could not afford to sell gas as cheap as the new company could and pay a dividend. If they did come down to low prices, the consumption would increase; but the pipes at present laid would not be large enough to convey sufficient gas to meet the increased demand if the consumption became doubled. The present companies admitted in their printed reports that they lost 29½ per cent. of their gas by leakage, which caused the bad odour experienced whenever the streets were opened. All that waste had to be paid for by the public before a dividend was declared. This leakage was occasioned by the fact that the manufacture of gas was in its infancy when those pipes were laid down; the inferior metal used soon corroded and oxidized, and all the companies in the United Kingdom were in the same condition as those of Dublin. The general rule was that one-third of the capital expended by the old companies would suffice to erect better works, and lay down pipes of a superior description. (Hear.) Cork was at present supplied with gas by the very same company as that which supplied Dublin—the Hibernian Gas Company; and it was supplied at the rate of 2s. 6d. per 1000 cubic feet. The necessary inference from this was, either that the price of gas was much too low in Cork or much too high in Dublin, where, including the tax upon meters, the price of gas was 5s. 6d. per 1000 cubic feet. (Hear, hear.) A company which could act in such a manner—supplying Cork at a cheap and Dublin at a dear rate—required to be narrowly watched; and the best possible check on such a company would be competition. (Hear, hear.) The public lamps burned 3600 hours during the year, and consumed 14,600 feet of gas each. At 2s. 6d. per 1000 cubic feet, for which the new company would supply them, or 50s. per lamp, a saving of £2000 per year would be effected to the citizens. Now, not only did they propose to light the public lamps at that rate, but they would undertake to supply gas 20 per cent. higher in its illuminating power than that supplied at present. (Hear, hear.) It was scarcely necessary to observe that the public lamps could be supplied at a cheaper rate than private consumers; because they were always consuming gas, and thereby keeping the apparatus constantly at work, by which the cost of wear and tear was lessened; and, besides, there was no risk from bad debts, and the cost of collection was very trifling. After supplying the public lamps at this rate the new company would have 8d. per 1000 cubic feet left on every 1000 that they sold, which he thought would be a fair profit. (Hear, hear.) A great deal of nonsense had been propounded about the price of gas, and they had circulated ideas with the view of showing the impossibility of obtaining gas at a cheap price in Dublin. They were told that coal was 20s. 9d. per ton in consequence of the heavy freights, and that it was therefore impossible to sell gas at a reasonable price. Now, the price of coal had really little or nothing to do with the price of gas, and he would show them why. A ton of Newcastle coal could be procured in Dublin for 14s., and it would produce 9000 feet of gas, 10 gallons of tar, 10 gallons of ammonia water, and 13 chaldrons of coke. Tar sold for 1s. a gallon, and coke for 10s. per chaldron, making 11s. to be deducted from the price of a ton of coal, sufficient to produce 9000 feet of gas, so that the cost of the raw material for 1000 feet of gas cost about 4d. (Hear, hear.) It stood to reason if they could develop such a trade as that, it would be better at low prices than it would be at high prices. As an illustration that the cost of coal does not influence, he might mention that at Newcastle-on-Tyne the cost of coal was 6s. per ton, a chaldron of coke only sold for 1s. 6d., and tar and ammonia at 6d. a gallon. There they produced only 2s., while here they produce 11s. It was a mistaken fancy that coal interfered with the price of gas; but these notions, of course, were always propounded by existing companies to try and make out their dodge, and the gentlemen who were associated with the new company were all noodles together, and had never inquired into these things, knew nothing about them, and were ready to make laughing stocks of themselves before a public meeting of the citizens of Dublin. Such was not the case, but he had not had an opportunity of replying to the false statements before. A gas company had a lever which no other company in existence was possessed of, for its clerks and inspectors were going about from shop to shop through the entire city; and if disposed to circulate statements injurious to that movement they could do so, and their only mode of contradicting them was coming to a meeting like that, and to do so in the most public manner. (Cheers.) He scarcely knew that there was any other topic in connexion with the company to which he need allude. They had got no opposition there which he was very anxious to have had. He thought they would see from what he had stated that he had completely made a case to show that they could supply gas at 3s. 6d. per 1000 cubic feet, and pay a dividend of 10 per cent. on their money; and, after paying that dividend, they would have 6d. or 8d. on every 1000 feet of gas they made to apply to profits, and a further reduction even in the price, even if they kept the tender sent in to the company. But his advice to the company was to do no such thing. If they made their own gas, instead of paying 1s. 9d., it would not cost more than 1s. 3d., including all loss from leakage between the works and the mains, being a clear benefit of 6d. per 1000 feet. If any profit was to be made from that, the company ought to have it; and so soon as their profits exceeded 10 per cent., they should make a reduction from 3s. 6d. to 3s. per 1000 cubic feet, and it would pay them far better than at a high price. (Cheers.) Many misstatements had been circulated in reference to the manufacture of gas in other towns as compared with Dublin, and a paragraph appeared in *Saunders' News-Letter*, taken from the *North British Mail*—a paper published in Glasgow—they went a long way off. The company sent that paragraph to the *North British Mail*, no doubt, from Dublin, which was afterwards copied into the Dublin papers, for the purpose of showing that gas in Dublin, when the reduction to 4s. 9d. took place, would be cheaper than it was in Glasgow. The fact was that in Glasgow the price of gas was 5s., with discounts bringing it down to 4s. 2d. The illuminating power of Glasgow gas was 26 candles, and that of Dublin was only 10 candles, so that the cost of gas in Glasgow was about 2½d. per candle, whereas it was 6d. per candle in Dublin. But these paragraphs were circulated in that way, sent up and down, with a view of trying to make the public believe that gas could not be made at a reasonable rate. In Liverpool they supplied gas, with an illuminating power of 18 candles, at the rate of 2s. 6d. per 1000, so that they got as much light for 2s. 6d. in Liverpool as cost the citizens of Dublin 6s. The same thing occurred in almost every town. In Birmingham it varied from 2s. 10d. to 3s. 9d. per 1000 cubic feet, and the various companies realized 10 per cent. on their capital. Wherever gas had been supplied at a reasonable price it always increased the prosperity of the company and was of advantage to the public. In Sheffield, in 1851, the price of gas was 5s. 10d. per 1000 cubic feet; a reduction took place, and it now varied from 3s. to 4s. per 1000. An amalgamation took place with the company he formed to oppose them, and they succeeded in saving to the city nearly £20,000 a year. The new company, in consequence of selling gas at a low price, was enabled to divide 10 per cent. on the capital, while the previous company could only get 8½ per cent., proving that where gas was sold at a low price the consumption increased and the public obtained the benefit. In proof of that principle, let them only read the advertisements of the Alliance Gas Company every day, stating that they expected an extension of trade through low prices; but there was a limit to the extension of the trade, for their pipes were put

down thirty years ago, and the consumption having doubled since then, they could not meet an increased consumption; so that their only mode was to bully their opponents, and to try to slander them in every way through the city, in order to try to damage them in public estimation. When facts were stated, and figures and arguments brought forward to show the contrary—if the public press reported their proceedings fairly—they did not at all fear the result. (Cheers.) There was a point in connexion with the company of vital importance—namely, that no shareholder could be called upon for a greater amount of money than the sum which he subscribed. The amount of a share was £5, and there were twenty months to pay it, and all that protection was afforded under the Limited Lability Act. Up to the present time they had obtained upwards of 450 applications for shares. They entered into contracts with more than 6000 consumers to take gas. They were not a company that anybody need be afraid to join. They had applications, in addition to the shares sold, for 20,000 more; but the object of the company was to prevail on the consumers themselves to look to the advantages which they would gain by securing this reduction in perpetuity by becoming shareholders. If each shopkeeper took one or two shares, and made it a consumers' company, that for ever prevented the possibility of an amalgamation, secured a reduction in private as well as public taxation, and benefited all parties concerned. (Cheers.)

Mr. JOHN MARTIN, T.C. (Fitzwilliam Ward), then proposed a resolution to the effect, "That the Dublin Independent Gas Company having satisfactorily explained its objects and position, and proposed to give gas at 3s. 6d. per 1000 cubic feet, through correct meters, free of rent, the meeting pledged itself to support the company by every means in its power." He said, after the very comprehensive and able statement of Mr. Flintoff, he really felt that the duty of entering at any length into the question had been discharged. Mr. Flintoff had dealt with all branches of the subject in such an elaborate manner, that very little remained to be said. But he apprehended that a company coming forward and presenting a prospectus to the public such as that of the Independent Gas Consumers' Company, was entitled at least to fair play, if not to favour. (Cheers.) He found among the names of the directors of the company those of gentlemen of standing and respectability in the city, and he thought that should prove these gentlemen were earnest in their intentions, and if aided by the citizens at large they would confer a great and substantial benefit on the city. (Cheers.) He was at a loss to know why gas should be an exception to all other classes of commodities that the citizens were supplied with. He could not understand why there should be a monopoly in gas that existed in no other business or branch of trade. (Hear, hear.) It was objected that the purport of the new company was to make money; but, he should like to know, was not that the object of every trader, of every merchant, who embarked in business? (Hear, hear.) He rather took it as an evidence of the *bonâ fides* of the transactions, that their allegation was that they desired to make money, coming forward with a prospectus, as they did, binding them to a particular course. If they did make money, then those gentlemen would have certainly fulfilled every item of their statement, that they could perform the lighting of the city cheaper than it was done by existing gas companies. He found likewise, in the clamour and opposition of the existing companies, very strong evidence that the statements of the new company were perfectly *bonâ fide;* for if they were a mere "bubble" company, and if it were a company formed for the purpose of making false statements, surely there need not be on the part of the existing companies such an anxiety as they had seen manifested on various occasions. (Hear, hear.) Surely, if they were a mere bubble company, not calculated to be successful in their objects, there was no ground for the course of procedure adopted by the existing companies; consequently, he thought, the very opposition they had made entitled the new company to a fair measure of support from the citizens of Dublin. (Hear, hear.) He understood that there had been six gas companies in Dublin, four of which amalgamated, under the name of the Hibernian Gas Company, and two under the name of the Alliance Gas Consumers' Company. They now found the two latter companies working harmoniously together; they found that, in districts where the Hibernian Company had the lighting, the Alliance Company were not opposing them, and that they had come to an understanding that in some places they were to put in contracts for a moiety of the lighting. When they found that state of things existing, surely it was time for a third company to intervene, and to secure to the citizens that to which they were entitled—namely, gas at a reasonable price. (Loud cheers.) He found a statement on the face of the prospectus of the new company that they undertook not to amalgamate with existing companies. He found there the name of the Lord Mayor elect—(cheers)—and the names of the gentlemen who had earned for themselves a reputation in the city, and who had been for years in business. He found the names of Mr. Ingram, Mr. Magill, and others, and that was a guarantee that they would carry out everything that they proposed. He thought, therefore, that a company of that kind was entitled to every measure of fair play and support; and certainly he conceived that if the citizens of Dublin extended their protection to existing monopolies, they would be very blind indeed to their own interests. (Hear, hear.) Allusion had been made to the public contracts for the lighting of the city, and he apprehended that was not a matter to be overlooked, because, if they permitted the existing companies to coalesce, they might, at the end of the contract, charge what they pleased; if no independent company existed, the other companies might come to any understanding they pleased, and charge anything they pleased for the lighting of the city. ("Hear," and cheers.) They could not, of course, starting and on the spot, set a new company in motion; they could not get all the plans necessary in a few months; but they ought to encourage the formation of a new company, so that they might make their own terms for the lighting of the city. That was a question in which every payer of rates, and every person interested in the welfare of the city, ought to look to. He likewise found that some difficulty had been raised with reference to the opening of the streets of Dublin for the purposes of the new gas company, but it was the first time that he had heard of such difficulties being thrown in the way of any company or association with regard to the opening of the streets. He thought any one who walked the streets would see that various companies, the Electric Telegraph Company and others, had opened the streets, and he was at a loss to know why the objection should be thrown in the way of the present company. A great many members of the other companies had positions, votes, and influence in the corporation, but he did not think that they would use their positions there to give opposition to that company. He believed, on the contrary, that those gentlemen in the corporation of Dublin in connexion with the existing companies would not give any sinister opposition, but would give every fair play and facility to any company coming before them for a public purpose—(cheers)—and if anything of that kind were attempted, he apprehended that the citizens of Dublin had the remedy in their own hands. ("Hear, hear," and loud cheers.) That would be a very illegitimate use of their power, if they were to throw obstacles in the way of a company coming into operation. In Cork, and other places that had been alluded to, companies had commenced their operations without any special Act of Parliament, and in the city of Dublin he apprehended it would not be different, and they also could procure an Act of Parliament. The appeal made by that gas company was a fair one. They asked for simple fair play. They asked that the statements which they made—statements made in a perfectly *bonâ fide* spirit—they asked that those statements should be fairly tried, and that the citizens of Dublin, as he was sure they would, should accord to that company a measure of fair play. (Cheers.)

Mr. MARTIN BURKE, T.C., seconded the resolution, which was put and carried unanimously.

The CHAIRMAN then said that the proceedings had gone on so harmoniously that the promoters of the company did not deem it necessary to submit any further resolutions, but if any gentleman present wished to ask any questions or to make any observations they were ready to hear him.

A VOICE: They are all dead.

Mr. HULL INGRAM having been called to the second chair, a vote of thanks, on the motion of Mr. Martin, seconded by the Lord Mayor elect, was passed to Mr. Grogan, and the meeting separated, having previously given three cheers for the city members at the request of Mr. Martin Burke.

## THE MANCHESTER GAS-METERS.

The following additional correspondence between Mr. Crosley and the Manchester Gas Committee has been handed to us for publication:—

*Gas Department, York Hotel Buildings, 53, King Street, Dec. 21, 1858.*

Dear Sir,—The gas committee are desirous of making arrangements for carrying into effect the suggestion made at the meeting of the council on the 1st instant, in reference to the examination of the various meters used in the experiments reported both on behalf of this corporation and yourself, as also any others which it may appear desirable should be so examined and reported upon.

I am instructed by the chairman to request that you will inform me whether you are willing to submit to Mr. Thos. Hawksley and Mr. Geo. Lowe, for examination and report, unreservedly and without any restriction (except as may relate to your being present at the time of examination), the meter reported upon by Mr. Taunton, and which is now, it is supposed, in your possession, and the 3-light and 29-light meters referred to in the report of Mr. Geo. Lowe and others, bearing date the 17th of November last, and advertised in the JOURNAL OF GAS LIGHTING.

You will have been already informed by the resolution of the meter sub-committee of the 15th inst., a copy of which was transmitted to you on that day, that the sub-committee intend to refer to the engineers before mentioned, for examination and report, without any stipulations whatever, the meters used in the experiments made and reported by Mr. Cleminshaw.—I am, dear Sir, yours truly,

Wm. Crosley, Esq., Gas-Meter Works, 103, Southwark Bridge Road, London. (Signed) THOS. PEACOCK.

(Copy)

*Gas-Meter Works, 103, Southwark Bridge Road, S.E. London, Dec. 27, 1858.*

Dear Sir,—Your favour of the 21st inst. has only reached my hands this morning, in consequence of my absence from London, to which place it has been returned after following me in the country.

In reply, I beg to say that I am ready to submit the meters named therein to the inspection of Messrs. Hawksley and Lowe, upon the distinct understanding that I am allowed to be present at all the experiments made on any meters manufactured by my firm which may be submitted to the examination of those gentlemen.—I am, dear Sir, yours faithfully, (Signed) WILLIAM CROSLEY.

Thos. Peacock, Esq., Gas Office, Manchester.

## PRESENTATION AT THE SURREY GAS-WORKS, ROTHERHITHE.

Christmas eve at the works of the Surrey Consumers' Gas Company was more than usually interesting, and the proceedings there on that occasion bespeak a happy state of feeling existing between master and man, truly gratifying to all concerned.

Mr. Croll, as is his custom at this season, had generously provided a large number of joints of mutton for the more deserving of his workmen. The men, with newly-washed faces, beaming with happiness and gratitude, all assembled in one of the company's spacious buildings, the walls of which were tastefully adorned with banners, evergreens, the rose, shamrock, and thistle, and other floral decorations, surmounted with "A. A. Croll" in large characters, around which beautiful festoons were gracefully entwined, while upon a table beneath were spread the goodly number of Christmas dinners.

Mr. HUNTER (the manager) addressed the men in a few appropriate remarks, and then distributed the substantial gifts to the numerous recipients. Whereupon one of the workmen proposed "Three cheers for Mr. Croll," their generous and deeply respected employer, which were loudly given, and heartily rejoiced in by all present.

At this point there was, as if by magic, disclosed to view upon the table, a very beautiful ormolu clock, under a glass shade, and bearing the following inscription chastely engraved on silver:—

Presented to Mr. David Hunter, jun., manager of the Surrey Consumers' Gas Company's works, by his working men, as a mark of their esteem and gratitude for his kindness and straightforward conduct towards them, as manager of their works.

Here one of the foremen stepped forward, and in a very sensible speech, of considerable length, spoke of the pleasure they felt in working for such employers. Not only had they an excellent one in Mr. Croll, but an able and efficient manager in Mr. Hunter—a master who, whilst he kept them unflinchingly at their duty, and encountered no difficulty which he did not surmount, yet knew the secret of serving his employer faithfully, without oppressing the working man. In their calling they were constantly receiving, in his forcible, but kind and familiar way, much practical instruction. In all this they appreciated such a master, and being very desirous of showing this in some substantial form, they had, with the utmost cheerfulness and perfect unanimity, now realized their wishes, and having considered this a most befitting occasion for accomplishing their object, he, for himself and on behalf of his fellow-workmen, now begged Mr. Hunter to accept this tribute of their respect and gratitude.

Mr. HUNTER rose to accept, but was quite overcome by his feelings. He offered his heartfelt thanks, but words could not express the estimation in which he would hold this costly gift, so unexpectedly received from a body of working men. It would ever be cherished in his memory, and would be handed down as an invaluable heirloom to his family. (Loud cheers.)

After this the men gave three cheers for the other officers of the company, to which Mr. SCHOMBERG responded.

Three more hearty cheers were given for the ladies and other visitors who had honoured the proceedings by their presence, specially naming Mrs. Hunter, whose kindness they had so often experienced.

Mr. HUNTER, sen., replied in very suitable and feeling terms, after which the large assemblage soon dispersed, wishing one another "a merry, merry Christmas."

The clock was obtained from Messrs. Savory, of Cornhill. It is a splendid and highly artistic piece of mechanism, and cost about twenty-two guineas. It was accompanied by a superbly-executed presentation address, handsomely framed.—*South London Journal.*

## SALFORD GAS-WORKS.

The annual report made by the Gas Committee to the Council of the Borough of Salford, gives the following as the results of their operations for the year ending June 30, 1858:—

| | |
|---|---|
| Gas rental (exclusive of meter-rents) | £28,903. 4s. 7d. |
| Total quantity of gas made | 152,037,500 cubic feet. |
| Cannel coal used | 14,413 tons, 18 cwt., 3 qrs. |
| Average yield of gas per ton of cannel | 10,540 cubic feet. |

A new exhauster has been fixed, at an expense, including the house, of £664. 19s. 11d., and a photometer and other experimental apparatus erected at a cost of £289. 11s. 3d.; also a new telescope gasholder, 100 feet diameter and 26 feet deep, the contract for which was £3100, and for the tank, £1570. The total profit for the year was £7810. 16s. 6½d., to be divided between the townships of Salford, Pendleton, and Broughton, as directed by the "Salford Extension and Improvement Act, 1853." The following is an abstract of the receipts and expenditure on the revenue and extension accounts.

### RECEIPTS.

| | | | |
|---|---|---|---|
| To balance at June 30, 1857 | | | £9,391 9 8½ |
| *Revenue Account.* | | | |
| Gas-rents | £23,487 2 2½ | | |
| Ditto outstanding at June 30, 1858 | 5,532 9 5 | | |
| | | 29,019 11 7½ | |
| Coke sold | £1,444 3 1½ | | |
| Gas tar ditto | 1,198 10 10½ | | |
| Ammoniacal water ditto | 297 5 1 | | |
| | | 2,939 19 1 | |
| Spent lime sold | | 34 9 11 | |
| Old iron ditto | | 46 4 1 | |
| Meters and boxes sold | £653 13 0 | | |
| Repairs to meters | 117 4 7 | | |
| | | 770 17 7 | |
| Interest allowed by bankers, less commission | | 44 12 5 | |
| *Extension Account.* | | | |
| Salford District Finance Committee—additional capital for extension of works | | 5,213 9 8 | |
| Rents of meters lent on hire, amount received | £159 18 8 | | |
| Ditto outstanding at June 30, 1858 | 77 7 3 | | |
| | | 237 5 11 | |
| Old iron sold | | 46 4 1 | |
| | | £47,744 4 1 | |

### EXPENDITURE.

*Revenue Account.*

| | | | | | |
|---|---|---|---|---|---|
| By salaries, wages, and poundage— | | | | | |
| Manager, H. Brothers, one year | | | £350 0 0 | | |
| Analytical chemist, Dr. R. Angus Smith, one year | | | 50 0 0 | | |
| Borough fund—Proportion of borough treasurer's salary, one year | | | 57 10 0 | | |
| Ditto, ditto clerk's salary, one year | | | 70 0 0 | | |
| Office clerks at works— | | | | | |
| R. Lawton, one year | £100 0 0 | | | | |
| J. Quarmby, ditto | 53 10 0 | | | | |
| W. J. Dobbs, office-boy, one week | 0 11 0 | | | | |
| J. Richmond, one year | 28 8 0 | | | | |
| Samuel Darwin, ditto | 25 8 0 | | | | |
| | | | 207 17 0 | | |
| Inspectors— | | | | | |
| R. Lynch, present inspector (portion of a year) | | | 72 2 10 | | |
| J. L. Cocker, late inspector (ditto) | | | 20 3 4 | | |
| W. Moore, one year | £78 0 0 | | | | |
| W. Wibberley, ditto | 62 8 0 | | | | |
| John Britland, ditto | 41 12 0 | | | | |
| W. F. Poulton, 36 weeks | 16 4 0 | | | | |
| H. Jones, 9 months | 15 12 0 | | | | |
| W. Wharton, 16 weeks | 7 4 0 | | | | |
| M. Carrol, 10 weeks | 4 0 0 | | | | |
| | | | 225 0 0 | | |
| Collectors' poundage— | | | | | |
| S. Long, one year | £180 0 0 | | | | |
| W. McFarlane, late collector | 37 16 4 | | | | |
| W. Stansfield, extra assistance | 9 1 9 | | | | |
| E. Wilcock, present collector | 112 2 6 | | | | |
| | | | 339 0 7 | | |
| | | | | | £1,400 13 9 |
| | Labour. | | Materials. | | |
| Gasmen's wages | £2,484 0 8 | | | | |
| Workmen and labourers at works | 791 14 3 | | | | |
| | | | | | 3,275 14 11 |
| Cannel | £ 32 13 3 | | £10,747 9 4 | | 10,780 2 6 |
| Clay retorts | 182 0 4 | | 216 10 0 | | |
| Firebricks and clay | | | 310 19 7 | | |
| | £182 0 4 | | £527 9 7 | | 709 9 11 |
| Lime | | | | | 272 8 10 |
| Ironwork and castings for works | | | | | 42 2 10 |
| Casual expenses on works, including travelling expenses | | | | | 124 12 5 |
| Repairing gasholder | | | | | 8 3 1 |
| Repairs to street mains, &c.— | | | | | |
| Repairing service-pipes | £ 52 18 6 | | £ 27 18 9 | | |
| Ditto street mains | 45 8 11 | | 31 15 2 | | |
| Ditto lamps | 28 10 6 | | 31 3 8 | | |
| Repaving and flagging | | | 31 5 4 | | |
| | £126 17 11 | | £122 2 11 | | 249 0 10 |
| Repairing water-pipes | | | | | 0 1 0 |
| Meters, boxes, and materials | £ 53 19 8 | | £763 8 4 | | 817 8 0 |
| Repairs to implements | 10 14 3 | | 14 13 4 | | 25 7 7 |
| Pumping water out of gasholder | | | | | 25 2 6 |
| Oil, paint, and cement | | | | | 23 10 3 |
| General office expenses, including repairs | | | | | 26 3 3 |
| Printing, stationery, and advertising | | | | | 114 8 4 |
| Local rates | | | | | 529 5 11 |
| Water-rent, one year, £40; leakage, £55. 13s. | | | | | 95 13 0 |
| Government tax, £379. 2s. 2d.; extra, £549 | | | | | 928 2 2 |
| Chief rent | | | £276 2 4 | | |
| Less paid by town hall, &c., committee | | | 100 11 0 | | |
| | | | | | 175 11 4 |
| Allowances and irrecoverable gas rents | | | | | 394 11 8 |
| Provender, and horse and cart hire | | | | | 42 3 7 |
| | | | | | £30,059 17 8 |
| Interest on invested capital of gas-works, one year, at 5 p. cent. | | | | | 3,319 19 6 |
| Allowance for depreciation, at 2½ per cent., on value of gas-works, at June 30, 1857 | | | | | 1,665 1 0 |
| | | | | | £25,044 18 2 |
| Apportionment of gas profits— | | | | | |
| Apportionment of one year's profits, to June 30, 1857 | | | | | 7,996 1 0 |

*Extension Account.*

| | Labour. | Material. | |
|---|---|---|---|
| Iron mains and service-pipes, and fixing lamp pillars and brackets | £536 9 0 | £1,461 4 4½ | £2,017 13 4½ |
| Repairs of streets (repaving) | | | 157 5 7 |
| Repairing water-pipes | | | 0 14 5 |
| Implements and apparatus | £19 3 7 | £38 14 6 | 57 18 1 |
| Horse, cart, and geers | | | 3 13 0 |
| Meters on hire | £56 18 3 | £695 19 10 | 752 18 1 |
| Photometer and apparatus | 19 8 4 | 147 4 3 | 166 12 7 |
| Experimental-room | 30 19 3 | 81 10 1 | 112 9 4 |
| Exhauster and appurtenances | 45 11 7 | 619 8 4 | 664 19 11 |
| Purifiers and house | | | 1 19 4 |
| Alterations to offices | £24 6 9 | £44 8 0 | 68 14 9 |
| New works, Regent Road— | | | |
| Tank—advance to contractor | | £315 3 5 | |
| Surveying | | 10 5 0 | |
| Salary of clerk of works | | 11 11 3 | |
| Office | | 12 7 6 | |
| Law expenses—conveyance of land | | 2 4 6 | |
| Printing and advertising | | 0 7 6 | |
| Casual expenses | | 8 6 4 | |
| Wages of workmen | | 10 11 9 | |
| | | | 370 17 3 |
| | | | £4,375 15 8½ |
| Balances at June 30, 1858, viz.:— | | | |
| Balance in the bank | | | 6,551 12 8 |
| Ditto of cash on hand | | | 98 0 11½ |
| Add balance of sums owing to and by the committee, viz.:— | | | |
| Sums owing to the committee | | £11,896 4 9 | |
| Less sums owing by the committee (including deposits, £1498. 19s. 6d.) | | 8,218 9 2 | |
| | | | 3,677 15 7 |
| | | | £47,744 4 1 |

## PUBLIC LIGHTS AT CROYDON.

The discussion which has been going on for some time between the Local Board of Health and the gas company relative to the price to be paid for the public lights was brought to a close at the last meeting of the board, when the following letter was read from the gas company:—

The directors of the gas company have been and still are very desirous that the price of the public lamps should be as fair and reasonable as possible, and with that view, before they sent you the terms upon which they were prepared to light the public lamps, they consulted an eminent gas engineer as to the lowest price that the public lamps could fairly be expected to be supplied at, and it was under his advice that the calculations contained in my letter to you of the 2nd of November last were made, upon the understanding that each lamp should burn on an average 5 feet an hour, and twelve hours per night.

This offer was considered by your board, and it was thought that a saving might be effected if the lamps were lighted ten instead of twelve hours per night, and your surveyor was requested to write to some other places similarly situated to Croydon for information, and then to advise your board what would be a fair and proper price for your board to pay for the public lamps if they were lighted for ten hours.

After obtaining the information, your surveyor informed your board that he considered the price asked by this company was not much beyond the correct charge, that the lamp columns could be bought now for a less sum than the gas company had stated; that the charge for repairing, &c., might be reduced a little; these two items might be fairly put at 15s. per lamp, and that if the lamps were lighted ten instead of twelve hours per night, the price per lamp per annum should be—For those lighted twelve months, £4. 16s. 10d.; and for those lighted nine months, £3. 18s. 8d. Upon this the gas company again consulted their engineer, and upon calculating the quantity of gas consumed during the ten hours per night for twelve months, they find that the gas alone at the low charge of 4s. 6d. per 1000 cubic feet amounts to £4. 2s., and adding to this for repairing, cleaning, lighting, turning out, interest on cost of columns, &c., the price advised by your surveyor as being fair and proper, makes for each lamp per annum £4. 17s.

And this sum the directors of the gas company are advised is the lowest price they ought to charge for the twelve-months lamp, with a proportionate reduction for those burning nine months.

The directors, however, are willing to accept the terms advised by your surveyor, viz., for the lamps burning twelve months, £4. 16s., and for those burning nine months, £3. 18s. 8d. But if your board would prefer that some other gas engineer should advise on the price to be paid, I am authorized to say that the directors of this company are willing to leave the question of price to any London gas company's engineer your board may choose to appoint; but in this case the arbitrator is not to be informed of the price at which the directors now offer to supply the lamps.

The CHAIRMAN inquired of Mr. Fenton, the surveyor to the board, if he had made his calculations upon the data furnished by the gas company, or upon data of his own?

Mr. FENTON: I think their calculation was a correct one, and if the lamps burn 5 feet per hour, their calculation was a fair one.

Mr. SUTHERLAND: But did you make the calculation upon their data?

Mr. FENTON: I believed it to be a fair one.

Mr. SUTHERLAND: Your rates were only got by taking the data of the gas company, and you therefore gave us your calculation based upon their data, deducting from their charges a small difference for the post-lamps, cleaning, &c., and for the smaller number of hours the gas was burnt?

Mr. FENTON: You could not make any other calculation. If their calculation was correct—which I believe it to be—you could do no other. It was only a matter of multiplication.

Mr. SUTHERLAND: These calculations of Mr. Fenton were based on the understanding that the gas company would do all they promised. I suppose that Mr. Fenton did not take into calculation that very frequently the burners became forked, and that in every case where that happens the burning is in favour of the company. When the board made their offer, we took these things into calculation, and we believed that the offer we then made was a fair one.

Mr. FENTON: I certainly made the calculation upon the fact that what the gas company promised, they would do; for, if they did not give 5 feet per hour, there would of course be a breach of contract.

Mr. CROWLEY: However much the gas company may wish it, I think it would be impossible for them to carry out their contract to the letter by burning 5 feet per hour. I think, in giving them the price we offered, we were about paying 4s. 6d. per 1000; and I think, if we give them the price they now ask for, we shall give them more than 4s. 6d. a 1000.

Mr. RUSSELL did not see why the board should pay less than a private consumer. He did not think that he should have the gas supplied to him in the road at a less price than he got it in his house. He would rather pay a fair price for his gas as a private ratepayer, and less than he was now paying as a private consumer, which he believed would be the case if the board paid the company a fair price.

Mr. CROWLEY: I think we are all willing to give a fair price, and we made, I think, the offer of a fair price. It does not follow that because they asked, we are to give them.

Mr. SUTHERLAND: I apprehend that all shopkeepers are supplied at a less price when they buy as wholesale customers, than when we who purchase in a retail manner.

Mr. RUSSELL: But then the difference between the 6s. and 4s. 6d.

Mr. SUTHERLAND: I do not think that too much difference between the wholesale and retail consumer.

Mr. CROWLEY: I believe we take one-fourth of the gas.

Mr. SUTHERLAND: I am inclined to attach much more importance to the corroding. I do not wish to complain of the light the company give, but I suppose Mr. Fenton must have seen what proportion of lamps have corroded burners.

Mr. FENTON: A good many; last night I should think I saw sixty in the town, but they were not then burning much less than 5 feet per hour.

Mr. CROWLEY: It was mentioned here some time since about erecting gas-works. I know a place where the Board of Health have done so, but they cannot sell gas; to do that they must leave it to some one. I am not acquainted with all the particulars, still I know it has been done.

Mr. SUTHERLAND: We cannot borrow money to erect the works; that is where we could not go on.

The CHAIRMAN: But we could ask some one to make gas for us.

Mr. CROWLEY thought that the Board of Health in paying 4s. 6d. per 1000 feet for their lamps paid 5 per cent. interest upon the capital of the company, as he believed gas was made for about 3s. per 1000 feet

Mr. OVERTON said it was not so. They were not making so much by the public lamps.

Mr. CROWLEY thought the Board of Health was partly in the hands of the gas company, and he was sorry the company had not taken the price offered.

Mr. OVERTON would ask the board if they had not always had a good light. He had noticed coming down from London the other night that Croydon was better lighted than any other place. Mr. Crowley and Mr. Crafton both said they did not complain of the light.

The CLERK: The company have offered you the option of having any engineer down from town.

Mr. OVERTON: That would increase the price.

Mr. CROWLEY proposed, and Mr. CRAFTON seconded, that the terms, as offered by the gas company, be taken for one year.

Mr. RUSSELL: No shareholder of the company can vote?

The CHAIRMAN: No. He then put the resolution, when Messrs. Crowley, Rigby, and Crafton voted for, and none of the other members against, some of them having shares in the company, the chairman therefore declared the motion carried.

## DR. R. ANGUS SMITH ON THE AIR OF TOWNS.

(From the *Quarterly Journal of the Chemical Society.*)

It is now a long time since I first sent a short paper on this subject to the Chemical Society, showing that the existence of organic matter in the air capable of decomposing, and actually undergoing decomposition, was not a matter of theory but of reality. At a later time I was able to confirm the fact, but a mode of readily ascertaining it in all degrees of amount has always been a great desideratum, a problem for pure science as well as for science in its relations to the welfare of man: this latter department is one which will always be most interesting to the greater number, and one which receives a constant impulse from the great amount of sickness existing in the world. I wish now to give some further particulars of the principal points which I have been able to ascertain. One or two of these have been subjects of professional inquiry, *i.e.*, made to serve a purpose connected with the interests of individuals or corporations or the demands of the law, but the greater portion, and that of most importance, has been gradually accumulated; and whilst making this observation I think it well to add that it seems to me a most unfortunate oversight that whilst laws have been made with relation to the impurity of the atmosphere arising from many causes, neither those who made the laws nor those who administer them have ever taken pains to find out what it really was against which they combated, and what crime that was which they have been so anxious to punish. The same carelessness has been observable on the side of those towards whom the law acted, and decisions have in reality been in the hands of those whose fancy or caprice have led them to take advantage of legal enactments; whilst great offenders have frequently escaped because no one has known the points on which they could be most easily assailed. The impurities of an atmosphere have been rudely guessed at, and the actual sources have been found only in a general manner; when particular cases have demanded attention, there has been great difficulty in arriving at well-defined concluclusions. As to any attempt to measure the degree of impurity in the air, none has been made to my knowledge, unless we take that gauge to be the true one which, in the Registrar-General's returns, presents us with a result where each per-centage stands for nearly 300,000 human lives.

If science can define precisely the extent of the evils which so affect human life, it may at a second stage also attain the important desideratum of a cure, and at any rate any inquiry of the kind must be of interest to all, but especially so to the medical and chemical professions.

In studying the air of towns in which coals are burnt, no place can give such an opportunity as Manchester, being the largest manufacturing town of the world, and itself being the centre of a great manufacturing district. Geographically, it is not the centre, being near the outskirts of the district on the south-west side, whilst on every other side manufactures extend for perhaps, on an average, thirty miles. They extend from the south and south-east on the borders of Cheshire and Derbyshire onwards to Preston on the north, Liverpool on the west, and into Yorkshire on the east; and within this district are large towns, little known to fame, but containing a great working population, having, besides wealth, both intelligence and force. In this district, comprehending many hundred square miles, there is every variety of scenery, but I believe every portion of it may be shown to be influenced by the smoke of the workshops. The tinge of darkness in the atmosphere may be seen making a line of at least forty miles in length, and affecting the appearance of the sky and the landscape. At the same time, it is marvellous how rapidly Nature asserts her superiority in all this accumulation made by art. The moment we leave a town we see everything greener and fresher, and the people larger, broader, happier, and cleaner; and so much so is this the case, that in the great district of which I have spoken, there is no doubt in the minds of those who are only a little removed from towns, that they are breathing the purest air. Nor is it without difficulty that we can perceive that the towns to some extent affect the whole district. The eye becomes accustomed to the stunted trees, and the many withered branches, and broken-up hedge-rows; nor is it customary to look at the state of the individual leaves to inquire how far degeneracy has advanced. The eye is sufficiently pleased to see the general aspect of pure green which refreshes us in every portion of the district, for the meadows in spring and summer seldom seem to suffer, but rather to be improved, partly by direct and partly by indirect assistance from the towns.

In some places, however, the destruction may be called total, the trees that exist being either absolutely dead or only capable of showing a very feeble life; and this, it seems to me, is very much the case in proportion to their height, although certain of them, such as the poplar, even if less tall, suffer on account of a greater delicacy. The smoke may either rise or fall, or move horizontally. It rises when the barometer is high, the air dry, and the sky clear, at which time we perceive very little of the effects on the ground; it falls when the clouds are low, or the air laden with moisture; then the whole district is equally enveloped in the haze. In general there is a movement of the air and a motion of the smoke in a direction more or less horizontal from the top of the chimney. By this means the highest objects are first attacked, and the trees decay from the summit, or from the upper part of that side exposed to the current. They resist the enemy for many years, keeping for a long time at least one side fresh; even the owners do not for years perceive that the district is gradually becoming unfit for plants of great height, but as they lose some favourite flower or shrub, they pitch on some person most easily attacked, and blame him for all the mischief.

About St. Helen's there are many miles of trees broken, stunted, and rotten, and between all the towns of Lancashire, according to the prevailing sweep of the wind, there are lines of dead hedges. Yet the young shrubs grow up without fear, as fresh and beautiful as anywhere; and all faith in their prosperity not being lost, there fortunately are still found persons who plant them. Absolute destruction is caused only by the direct action of the smoke, but a general weakness may be seen extending far beyond this, resulting in a less capacity of resisting the attacks of external influences.

As to the effect on the inhabitants, the question becomes exceedingly complicated, but the Registrar-General's returns are an unanswerable reply as to the result of the total influences of the district. Few people seem clearly to picture to themselves the meaning of a decimal place in the per-centage of death, and few clearly see that there are districts of England where the deaths at least in some years, and when no recognized epidemic occurs, are three times greater than in others. When we hear of the annual deaths in some districts being 3·4 per cent., and in the whole of England 2·2, it is simply that 34 die instead of 22, whilst even that is too slightly stated,

as the whole of England would show a lower death-rate if the towns were not used to swell it.

One of the conditions of health, and a most important, if not the most important of all, is to be found in the state of the atmosphere.

*Combustion of the Carbon.*

According to the best founded data, there are burnt in the course of a year in Manchester two million tons of coals. Now, supposing the district in which it is burnt to be 4 miles square or 16 square miles, and the height of atmosphere which is used by the inhabitants to be 60 feet, and the amount of carbon in the coal to be 75 per cent., we have introduced into this region in the course of a day 15,066 tons of carbonic acid, or 1·6499 per cent. of the air. Now, it may be said that the region is not correctly laid out; that 16 miles is too extensive, and 60 feet is not sufficiently high. In fine weather I believe that the atmosphere is influenced by the smoke at least to the height of 600 feet. If that extent were taken, we should find the amount of carbonic acid equal to 0·16499 of the air. But as a medium will probably be correct, let us say 300 feet high, and the amount will then be 0·33 per cent. of carbonic acid thrown into the air.

The several cases will stand thus—

| | |
|---|---|
| On a space of square miles, 60 feet high, there is an amount of carbonic acid from coals | = 1·6499 per cent. |
| To this add the amount already in the air | ·06 " |
| Now, supposing 400,000 inhabitants give out 266 cubic feet of respired air with 6 per cent. of carbonic acid, there will be 330 tons, or | ·0362 " |
| Total carbonic acid | = 1·7461 " |

If this were changed ten times a day, the result would be, at any given period,

| | |
|---|---|
| $CO_2$ from coal | 0·16499 per cent. |
| $CO_2$ from breath | 0·00362 " |
| Usual amount of $CO_2$ in the air | 0·06 " |
| Total at a given time | 0·22861 " |

If the air were changed twenty times a day, the result would be—

| | |
|---|---|
| $CO_2$ from coals | 0·08248 per cent. |
| $CO_2$ from expired air of inhabitants | 0·0018 " |
| $CO_2$ of the atmosphere | 0·06 " |
| | 0·14428 " |

But as a medium state is common, let us suppose the height to be 300 feet, changed ten times a day, then the result is—

| | |
|---|---|
| $CO_2$ from coals | 0·033 per cent. |
| $CO_2$ of expired air | 0·00072 " |
| $CO_2$ of the atmosphere | 0·06 " |
| | 0·0937 " |

The average speed of the air at Liverpool is equal to 12·62 miles per hour, by the observations of Mr. Hartnup, F.R.A.S., of the observatory there; let us say twelve miles at Manchester. It would sweep over the four miles three times an hour or thirty-six times in twelve hours.

This would give, with the height of 300 feet—

| | |
|---|---|
| $CO_2$ from coals | 0·0091 per cent. |
| $CO_2$ from expired air | 0·0002 " |
| Usual amount | 0·06 " |
| | 0·0692 " |

So that states of the atmosphere occur when the amount is very small when put into figures. Allowing the air outside the town to have 0·03 of carbonic acid, which is rather above the amount found on the sea-shore and the hills, and allowing the conditions in other respects to be the same as the last-mentioned, we have—

| | |
|---|---|
| $CO_2$ from coals | 0·0091 per cent. |
| $CO_2$ from expired air | ·0002 " |
| Natural $CO_2$ | ·0300 " |
| | ·0393 " |

This is less than the amount which I have at any time found, but may probably be taken as the extreme limit.

When we examine the subject in this manner, we perceive how small is the actual amount of effect which the accumulated efforts of art can produce on nature, and we are inclined to look on the result as not to be regarded. Repeated observations of various chemists have until lately pronounced the air of towns to be equal, as far as composition is concerned, to that of the air most distant from human habitations. The experience of mankind has been against this, but it has been believed that science was unable to obtain a method of observation which could equal the test of the human lungs, or still more of the continued action of the lungs during the whole length of even a shortened life. These calculations agree so far with the results obtained that I am disposed to think that each is nearly true in its turn, and that times do occur when the per-centage of carbonic acid is as high as in the first supposition. Such periods, however, are of brief duration, or have at least not occurred lately for more than a day at a particular place. When the carbonic acid was estimated by passing the air through a potash bulb apparatus very slowly for a whole day, a similar variety of results was obtained, but in equal weather and equal wind the results were very uniform. During the time the following experiments were being made, the weather was remarkably open and fine, and the results were lower than what I have sometimes calculated for the air outside the town.* When there is much wind blowing, they average from 0·045 to 0·08 per cent.; when less, they average from 0·10 to 0·12; making the amount of carbonic acid decidedly different from the amount in the country. It still remains a question, whether the amount is capable of affecting human life, and if the effect of the town atmosphere on health be not wholly attributable to other causes; I still believe that the carbonic acid is by no means the most important cause.

The carbonic acid was first determined by absorption with potash. The air was previously passed through sulphuric acid and chloride of calcium by an aspirator. The experiments were made at the Literary and Philosophical Society, George Street, Manchester.

No. 1.—February 25, 1858.

| | Grs. |
|---|---|
| Total weight after experiment | 1906·50 |
| " " before " | 1901·64 |
| Difference | 4·86 |

14·63 cubic feet of air used. $CO_2$ = 0·04095 per cent.

* I ought to have made simultaneous determinations of the air inside and outside the town. I hope to do so.

No. 2.—March 16.

| | Grs. | Aft. Exper. Grs. |
|---|---|---|
| Potash bulbs, first | 335·280 | 324·200 |
| " " second | 482·030 | 479·000 |
| Chloride of calcium and tube | 865·555 | 879·100 |
| Sulphuric acid apparatus | 805·080 | 810·650 |
| Total weight after experiment | 2492·950 | |
| " " before " | 2488·665 | |
| Difference | 4·285 | |

9·2 cubic feet of air used. $CO_2$ = 0·0573 per cent.

No. 3.—March 18.

| | Grs. | Grs. |
|---|---|---|
| Potash bulbs, first | 537·760 | 489·100 |
| " " second | 413·220 | 452·60 |
| Chloride of calcium tube | 875·00 | 895·90 |
| Sulphuric acid apparatus | 819·79 | 830·02 |
| Total weight after experiment | 2647·62 | |
| " " before " | 2645·77 | |
| Difference | 1·85 | |

5 cubic feet of air used. $CO_2$ = 0·0455 per cent.

No. 4.—March 19.

| | Grs. | Grs. |
|---|---|---|
| Potash bulbs, first | 443·00 | 440·90 |
| " " second | 490·00 | 489·60 |
| Chloride of calcium tube | 873·84 | 880·04 |
| Sulphuric acid apparatus | 829·66 | 831·73 |
| Total weight after experiment | 2642·27 | |
| " " before " | 2636·50 | |
| Difference | 5·77 | |

4·6 cubic feet of air used. $CO_2$ = 0·1544 per cent.

No. 5.—March 20.

| | Grs. | Grs. |
|---|---|---|
| Potash bulbs, first | 440·90 | 440·75 |
| " " second | 489·60 | 489·77 |
| Chloride of calcium tube | 877·63 | 879·60 |
| Sulphuric acid apparatus | 829·66 | 830·72 |
| Total weight after experiment | 2640·84 | |
| " " before " | 2637·79 | |
| Difference | 3·05 | |

6·91 cubic feet of air used. $CO_2$ = 0·0544 per cent.

No. 6.—March 22.

| | Grs. | Grs. |
|---|---|---|
| Potash bulbs, first | 439·70 | 440·75 |
| " " second | 474·90 | 489·77 |
| Chloride of calcium tube | 886·00 | 873·67 |
| Sulphuric acid apparatus | 830·80 | 832·43 |
| Total weight after experiment | 2636·62 | |
| " " before " | 2631·40 | |
| Difference | 5·22 | |

5·38 cubic feet of air used. $CO_2$ = 0·1195 per cent.

No. 7.—March 23.

| | Grs. | Aft. Exper. Grs. |
|---|---|---|
| Potash bulbs, first | 417·575 | 413·070 |
| " " second | 393·560 | 393·342 |
| Chloride of calcium tube | 874·050 | 876·005 |
| Sulphuric acid apparatus | 809·200 | 814·290 |
| Total weight after experiment | 2496·707 | |
| " " before " | 2494·385 | |
| Difference | 2·322 | |

2·256 cubic feet of air used. $CO_2$ = 0·0973 per cent.

No. 8.—March 24.

| | Grs. | Grs. |
|---|---|---|
| Potash bulbs, first | 393·342 | 392·950 |
| " " second | 413·000 | 412·450 |
| Chloride of calcium tube | 876·005 | 876·442 |
| Sulphuric acid apparatus | 814·150 | 817·012 |
| Total weight after experiment | 2498·854 | |
| " " before " | 2496·497 | |
| Difference | 2·357 | |

2·98 cubic feet of air used. $CO_2$ = 0·0972 per cent.

No. 9.—March 26.

| | Grs. | Grs. |
|---|---|---|
| Potash bulbs, first | 442·57 | 462·57 |
| " " second | 501·28 | 472·40 |
| Chloride of calcium tube | 875·78 | 875·37 |
| Sulphuric acid apparatus | 487·56 | 499·00 |
| Total weight after experiment | 2309·34 | |
| " " before " | 2307·19 | |
| Difference | 2·15 | |

4·6 cubic feet of air used. $CO_2$ = 0·0575 per cent.

No. 10.—March 27.

| | Grs. |
|---|---|
| Total weight after experiment | 2311·42 |
| " " before " | 2309·34 |
| Difference | 2·08 |

3·83 cubic feet of air used. $CO_2$ = 0·0668 per cent.

By these experiments we have—

| | | |
|---|---|---|
| No. 1 | 0·0409 | per cent. $CO_2$ |
| 2 | 0·0573 | „ |
| 3 | 0·0455 | „ |
| 4 | 0·1544 | „ |
| 5 | 0·0544 | „ |
| 6 | 0·1195 | „ |
| 7 | 0·0973 | „ |
| 8 | 0·0972 | „ |
| 9 | 0·0575 | „ |
| 10 | 0·0668 | „ |

Average of carbonic acid = 0·07908 per cent.

The amount of carbonic acid obtained on the hills near Preston was 0·022 per cent., and another time at Blackpool 0·03. If this were the mean of the air supplied to Manchester, the increase by smoke and other substances would be 0·049 in the centre of the town. I have not ascertained its average condition when it enters Manchester. 0·049 will represent the causes operating over all the county. High winds and stormy weather diminish the carbonic acid very much.

The next peculiarity in the air to which I will call attention is the sulphurous and sulphuric acids, and to judge of this, I have here given analyses of various coals used in Manchester.

*The Sulphur.*

The table gives the analyses of seventy-one specimens, some of which have amounts of sulphur as high as 5 and even 6 per cent.; but leaving out these, we have from sixty-six specimens of coals used in Manchester, an average of above 1 per cent. of sulphur; or, let us say, 1 per cent. as the lowest amount we can be allowed to assume. If we take 1 per cent. as the average amount, we have 54·79 tons of sulphur burnt daily, producing 167·8 tons of sulphuric acid. This would give in the assumed space of sixteen miles a grain of sulphuric acid to 101·72 cubic feet, or 1 in 54,455 grains, or 0·0018367 per cent. by weight: by volume it would appear much less.

*Amount of Sulphur in Coals used in Manchester.*

| | Sulphur per Cent. | | = SO HO |
|---|---|---|---|
| 1. A mixture of equal parts of thirty-two specimens of coal gave an average of sulphur. . . | =1·4208 | .. | 4·3509 |
| 2. Average in a mixture of coal used by seventeen of the largest consumers. . . . . | 1·1512 | .. | 3·5255 |
| 3. Average of another mixture of nine coals . . | 2·3488 | .. | 7·1957 |
| 4. . . . . | 0·502 | .. | 1·5374 |
| 5. . . . . | 2·399 | .. | 7·3487 |
| 6. . . . . | 2·224 | .. | 6·811 |
| 7. . . . . | 4·965 | .. | 15·2071 |
| 8. . . . . | 2·034 | .. | 6·2303 |
| 9. . . . . | 2·951 | .. | 9·038 |
| 10. . . . . | 1·008 | .. | 3·087 |
| 11. . . . . | 6·197 | .. | 18·9789 |
| 12. . . . . | 5·308 | .. | 16·258 |
| 13. . . . . | 2·158 | .. | 6·610 |
| 14. . . . . | 0·602 | .. | 1·8462 |
| 15. . . . . | 1·227 | .. | 3·7583 |
| 16. . . . . | 0·508 | .. | 1·5557 |
| Average of seventy-one specimens . . . . . | 1·665 | .. | 5·099 |
| Average of sixty-four specimens, the seven highest being removed . . . . . | 1·43 | .. | 4·37 |
| 1 per cent. gives of sulphur . . . . . | = | .. | 3·0625 |

*Sulphur-Acids in the Air.*

In order to obtain the amount of sulphurous and sulphuric acids, I passed the air through acetate of lead. The mode of experimenting here also was to draw the air slowly through the solution, taking care to have a sufficient number of bulbs. Two of Liebig's potash apparatus were quite enough, the last bulbs having no deposit. The water drawn off by the aspirator was measured.

128·8 cubic feet of air gave, with acetate of lead, a precipitate of sulphate of lead . . . . . =0·2

60 cubic feet gave . . . . . 0·095

The first is equal to 1 grain of sulphuric acid $SO_3HO$ in 2000 cubic feet.

The second is equal to 1·076 grains in 2000 feet.

This by weight is 0·0000934 per cent., or say 0·0001 per cent.

These experiments were made whilst the air was dry, or at least whilst there was no rain; the passage of the air through the lead solution being always interrupted during wet weather. An experiment lasted generally for about two months.

The above were made at my laboratory at All Saints, in a situation where an average of the four miles of district might be expected.

Others in the centre of the town, at the Literary and Philosophical Society, gave—

1st. 0·0042 per cent. of $SO_3HO$.
2nd. 0·0017 „ „

The first of these determinations was made whilst the weather was rather moist and the acid would probably fall, whilst a moist atmosphere, with as much acid as it could obtain, would pass into the solution. The second is very little below the calculated amount. The amounts differ considerably, but the smell has long ago decided on the fact of a great variation in the amount. One is surprised, after all, at the minuteness of these figures.

At the same time, the amount calculated is, in my belief, much too high for an average; and there is another method by which we may find an explanation of the fact that a smaller amount is obtained by experiment.

On examining some smoke from chimneys, I found that in 100 cubic feet (reduced to 65° Fahr.) there were—

| | Sulphur in Grains. | | $SO_2$ | | $SO_3$ | | $SO_3HO$ |
|---|---|---|---|---|---|---|---|
| 1. | 8·13 | = | 16·26 | = | 20·325 | = | 24·05 |
| 2. | 11·925 | = | 23·850 | = | 29·812 | = | 36·522 |
| 3. | 2·666 | = | 5·322 | = | 6·653 | = | 8·150 |
| 4. | 2·635 | = | 5·271 | = | 6·529 | = | 8·072 |
| Average . | 6·328 | = | 12·651 | = | 15·829 | = | 19·1986 |

These I consider examples of the amount of sulphur from chimneys giving out a large amount of sulphur, and others giving a comparatively small amount. As the amount of carbonic acid was not under 4 per cent., it is clear that all the sulphur actually in the coal is not made apparent in the smoke by this mode of burning. Mr. Spence, of Manchester, first called attention to the probability that the amount of sulphur-acids would greatly increase if the smoke were thoroughly burnt, believing that the sulphur is driven off at present uncombined in company with the carbon. In the few specimens of soot which I have examined, I have not found free sulphur. Sulphuretted hydrogen is rare, and cannot account for the absence of sulphurous acid; and sulphuret of carbon, which is produced by the distillation of coal, may be the chief mode by which sulphur is removed, as Dr. Bernays suggested to me. Although, then, it seems to be shown that a great portion, if not all, of the coal used is burnt in such a way as not to give its maximum of sulphur-acids, it is also true that from other circumstances certain districts receive even more than their average into the atmosphere. I am ready to believe, then, that the evils arising from sulphur-acids in the air are somewhat diminished by the wasteful and offensive method of burning coals now practised; but the diminution is not sufficient to be looked on as a cure, and it may be even questioned whether the black carbon sent into the atmosphere does not produce worse results. I have spoken chiefly of sulphuric acid as the medium of removing the sulphur, and I am disposed to view it as the chief, if not the only, final product. I have always obtained the sulphur in that state; it seems to be rapidly oxidized when mixed with large volumes of air. At the same time, it is well known that sulphurous acid is the form in which, to a large extent, the sulphur is removed by the chimneys, and that for a time it exists as such in the air. It requires no more than the ordinary senses to decide this question. The mode of oxidizing the sulphurous acid may be simply by the immense excess of oxygen supplied, but it may also be oxidized by the ozone of the atmosphere. In doing this, the ozone itself would be destroyed. This could be done by an amount equal to 8 of ozone for 49 of sulphuric acid—or say one-sixth—an amount sufficiently small to be readily supplied.

*Ozone.*

As to ozone, repeated attempts have failed to discover any indication near my laboratory and in one or two other parts of the town. At the distance of nearly one mile I found distinct indications in about two hours, at the sea-side (Blackpool) in less than half an hour, and even on the paper left on my bedroom table at that place during the night. This remarkable substance furnishes a sufficient proof of a distinct difference in the quality of the atmosphere in these places; its absence alone would completely destroy all attempts to prove that the air is not perceptibly altered by towns. At Rochdale, when the east wind was blowing from the hills, there were indications of ozone in a short time, or in less than an hour. At the same place, when the wind was blowing from the town and from the great manufacturing district west of it, no indications were perceived.

*Acidity.*

In pure air at the sea-side (Blackpool) litmus paper was made slightly less alkaline by exposure for a whole night during a sea-breeze. In other words, the blue colour was somewhat diminished.

In Manchester, blue litmus paper becomes red in half an hour at most, sometimes in ten minutes.

In my earlier papers on the rain, I mentioned that I frequently found alkaline rain. I did not at that time try the experiment so far in the town. My present laboratory is only a few hundred feet nearer the chimneys, but I see the effect distinctly. Polished brass apparatus does not keep so well, and the rain is always acid. Of late years I have found no alkaline rain in any portion of what is actually the town. The amount of acidity is such as to colour blue litmus at once; one drop falling on the litmus at once reddens it. One may, by this very simple means, obtain a very clear idea of the extent to which the air is deteriorated by smoke from coals containing much sulphur.

The acidity of the rain in various districts of Manchester was measured for an object to which I was led in the course of my profession. An alkalimeter was used, and a solution of alkali containing one grain of carbonate of soda to 1000 grains of water. One thousand grains by measure of the water to be tested were used; it was boiled in a flask during the process of testing, and mixed with a solution of litmus, previously taking care to ascertain how much acid was required to acidify or redden the amount of litmus used, so as to subtract it from the number obtained. It is generally better that experiments to be compared should be done by the same person, as the eye gets accustomed to its own peculiar method of judging of shades, and arrives at the results with wonderful constancy.

*Pendleton, N.W. District of Manchester.*

| | | |
|---|---|---|
| Wind blowing to the town, 1000 grs. of rain-water rendered acid by . . . . . | 6 | of the alkaline solution. |
| Not directly from the town . . . . . | 16 | „ |
| Wind touching the outskirts of the town . | 17 | „ |
| From town . . . . . | 36 | „ |
| From country . . . . . | 0 | „ |
| At All Saints' Church. . . . . | 24 | „ |
| „ „ . . . . . | 38 | „ |
| For a short time . . . . . | 140 | „ |
| Then fell to . . . . . | 40 | „ |
| Next to . . . . . | 40 | „ |
| And lastly . . . . . | 16 | „ |

*Ancoats.*

| | | |
|---|---|---|
| 1000 grains of rain saturated by . . . . | 44 | of the alkaline solution. |
| „ „ . . . . | 20 | „ |
| „ „ . . . . | 57 | „ |
| Average . . . . . | 40 | „ |

The rain in these cases was collected in porcelain vessels. In the following it was merely taken out of stone cisterns, which the inhabitants generally use for collecting water from the roofs of the houses. It will be seen that the results are similar. The weather being wet and the water frequently drawn off, there was little time for evaporation.

*Water from Cisterns in Pendleton.*

| | | | |
|---|---|---|---|
| No. 1. | 1000 grs. of rain-water required | 5 | of alkaline solution. |
| 2. | „ „ „ | 5 | „ |
| 3. | „ „ „ | 6 | „ |
| 4. | „ „ „ | 10 | „ |
| 5. | „ „ „ | 38 | „ |
| 6. | „ „ „ | 64 | „ |
| 7. | „ „ „ | 46 | „ |
| 8. | „ „ „ | 40 | „ |
| 9. | „ „ „ | 12 | „ |
| 10. | „ „ „ | 14 | „ |
| Average . . . . . | | 25 | „ |

Going over a part less built upon, the variations were according as chimneys were met with on the way or otherwise.

| | | | |
|---|---|---|---|
| No. 1. | 1000 grs. of rain-water required | 24 | of alkaline solution. |
| 2. | „ „ „ | 21 | „ |
| 3. | „ „ „ | 0 | „ |

4. 1000 grs. of rain-water required 27 of alkaline solution.
5. " " " 0 "
6. " " " 39 "
7. " " " 0 "
8. " " " 15 "
9. " " " 28 "

Average . . . . . 17 "

*Lower Broughton.*

No. 1. 1000 grs. of rain-water required 8 of alkaline solution.
2. " " " 33 "
3. " " " 26 "
4. " " " 12 "
5. " " " 21 "
6. " " " 23 "
7. " " " 29 "

Average . . . . . 21 "

*Hulme.*

No. 1. 1000 grs. of rain-water required 31 of alkaline solution.
2. " " " 26 "
3. " " " 32 "
4. " " " 34 "
5. " " " 49 "
6. " " " 27 "
7. " " " 33 "
8. " " " 29 "
9. " " " 36 "
10. " " " 28 "
11. " " " 47 "
12. " " " 34 "
13. " " " 41 "

Average . . . . . 34 "

*Salford.*

No. 1. 1000 grs. of rain-water required 10 of alkaline solution.
2. " " " 6 "
3. " " " 50 "
4. " " " 0 "
5. " " " 51 "
6. " " " 6 "
7. " " " 26 "
8. " " " 21 "
9. " " " 22 "
10. " " " 28 "
11. " " " 20 "
12. " " " 22 "
13. " " " 23 "
14. " " " 10 "

Average . . . . . 21 "

*Ardwick.*

No. 1. 1000 grs. of rain-water required 24 of alkaline solution.
2. " " " 40 "
3. " " " 24 "
4. " " " 45 "

Average . . . . . 33 "

*Ancoats*, containing numerous mills and inhabited by a working population only.

No. 1. 1000 grs. of rain-water required 41 of alkaline solution.
2. " " " 28 "
3. " " " 60 "
4. " " " 40 "
5. " " " 24 "
6. " " " 28 "
7. " " " 68 "

Average . . . . . 41 "

The average number is 28·5 for the whole.

Over 16 miles, and with a rainfall of 3 feet deep, we have 971, or say 1000 tons of sulphuric acid falling in rain during the year. As we had over this space burnt sulphur equal to 1 per cent. on the coal, it would give an amount equal to 61,245 tons of sulphuric acid in a year. The rain, therefore, returns only 1·588 per cent. of the quantity produced. But let us suppose that it rains one-sixth of the year, that time will receive all the benefit of the purification, equal to 9 per cent., and certain portions still more, according to the amount of stagnation of the air. As an example, the first rain falling on a particular occasion was at 140, but soon fell down to 40 of acidity; and, during a violent shower, I found the carbonic acid of the air to be only 0·056 per cent., whilst the rain contained 7·23 cubic inches per gallon.

*General Impurities in the Rain.*

The rain was found to vary a good deal in the amount of its impurities. The following gives the number of grains per gallon:—

| | | | | |
|---|---|---|---|---|
| Rain at All Saints Aug. 1857 | 7000 grs. | inorganic | 0·265 grs. | |
| | 2000 " | organic matter | 0·25 | " |
| | | inorganic | 0·1 | " |
| Ancoats | 1000 " | organic | 0·1 | " |
| | | inorganic | 0·8 | " |
| Pendleton | 4,000 " | organic matter | 0·19 | " |
| | | inorganic | 0·14 | " |
| | | | 0·33 | " |
| Rain at All Saints | 10,000 " | organic | 0·34 | " |
| | | inorganic | 0·66 | " |
| | | | 1·00 | " |

The inorganic matter consisted of—

| | |
|---|---|
| Peroxide of iron . . . . . | 0·245 grs. |
| Sulphate of lime . . . . . | 0·177 " |
| And rest not ascertained . . . . | 0·238 " |
| | 0·660 " |

The inorganic matter is chiefly coal ash. The organic matter is partly products of the distillation of coal.

*Mode of estimating Carbonic Acid.*

When examining the action of the manganate and permanganate of potash on sugar, the points that seemed to me most remarkable were, first, that very minute quantities of carbonic acid converted the green into the red acid; and next, that very minute quantities of organic matter entirely destroyed the latter. When a carbonate of an alkali containing more than an equivalent of carbonic acid is added to the manganate of potash or soda, a decomposition ensues, and it is at once rendered red. This salt, called the mineral chameleon, has long been remarkable for this sudden change of colour. When poured into water, apparently and really pure for all ordinary purposes, its appearance is entirely changed, and it is, in fact, decomposed. But it will be found that water has only a limited power of changing it, and this power depends on the amount of carbonic acid and organic matter. If these be removed, or if they be destroyed by the manganate, an additional amount may be employed without any change whatever taking place; Forchammer, in fact, proposed to use permanganate of potash as a mode of estimating organic matter in water, and the method has been less adopted than it deserves to be.

It occurred to me to use this susceptibility to carbonic acid as a mode of estimating its amount. When the manganate of potash is dissolved in water, enough being added to give a bluish purple tinge, the solution may be kept in well stoppered bottles without apparent change for at least many weeks; but if frequently used, it will not keep so long without change. The greatest care must be taken when working with it that no breath should blow upon it, and that no foul air of any kind should approach it. If it is to be transferred to another vessel, that vessel must previously be rinsed out with a portion of the manganate solution, as any water which can ordinarily be used for washing a bottle will destroy some of the solution, and it is better to throw that decomposed part away at once.

A standard solution of carbonic acid was made by filling a bottle with hot and well boiled water, and when cool, adding bicarbonate of potash. The solution first made contained 2·1227 grains of the salt in 5500 grains of rain-water. (The bicarbonate of potash gave by analysis 44·98 per cent. of carbonic acid by the common method of loss of weight.) This solution will then contain 0·48645 grains of carbonic acid not wanted to form the protocarbonate.

A solution of blue manganate was then made very dilute; of this 50 grains were reddened by the bicarbonate solution:—

1st . . . . . 850 grs.
2nd . . . . . 846 "
3rd . . . . . 848 "

As each grain of the solution is equal to 0·0000884 of a grain of carbonic acid, I look on these numbers as identical; it would be affectation, but no greater accuracy, to make them arrive within one grain each time.

Having obtained constant results on remarkably minute quantities, the test was then tried with gaseous carbonic acid: the results of these trials I do not find by me at present, but they were equally minute with those obtained by means of bicarbonate of potash, and more so than could be obtained without much trouble by the ordinary methods.

It was believed that the solution coming in contact with the acid of the atmosphere would cause a reddening with so much delicacy that the amount of carbonic acid might be estimated. The experiment was made in a bottle of known capacity, the air being extracted by pumping it out from the bottom, and so allowing a fresh current continually to enter. It is safer to fill it by extraction than by forcing, as the pump is apt to communicate some modification to the air.

Another solution of bicarbonate of potash was prepared by dissolving 21·227 grains of the pure crystals in 5500 of prepared water. Each grain would contain 0·001802 cubic inches of available carbonic acid. A solution of manganate of potash was made, 73 grains of which were reddened by 100 grains of the bicarbonate solution. The following experiments were then made, to estimate the amount of carbonic acid in the air in the centre of Manchester:—

| | | | | |
|---|---|---|---|---|
| 87 cubic inches of air decomposed | 35 grs. | $CO_2 = 0·0981$ | per cent. | |
| 87 " " " | 36 " | $CO_2 = 0·1012$ | " | |
| 87 " " " | 34 " | $CO_2 = 0·0955$ | " | |
| 87 " " " | 32 " | $CO_2 = 0·0899$ | " | |
| 87 " " " | 33 " | $CO_2 = 0·0927$ | " | |
| In a closed-up and crowded railway carriage, | | 0·3484 | " | |

These are my earliest results, and seem rather high. I have nevertheless retained them; since that time, there being a good deal of high wind or wet weather, no such amount has been obtained, and a few days ago I obtained the following very moderate results:—

May 17, a very wet day, gave, with another solution, the following results. The solution used had the following strength:—
50 grs. of manganate solution = 140 of the KO. $2CO_2 = 0·01232$ of $CO_2$ or each grain of manganate equal to 0·000601 per cent. of carbonic acid when 87 cubic inches were operated on.

1. 87 grs. of manganate = 0·0522 of $CO_2$ in the air.
2. 91 " " 0·0546 "
3. 95 " " 0·0570 "
4. 94 " " 0·0564 "
5. 98 " " 0·0588 "
6. 97 " " 0·0583 "

Next day was very dry, the air clear, and the wind high: the amount is still small. The experiments were not made together.

7. 113 grs. of manganate = 0·0679 of $CO_2$ in the air.
8. 156 " " 0·0937 "
9. 118 " " 0·0709 "
10. 118 " " 0·0709 "

On a very wet day, in a part of Manchester where a great deal of carbonic acid might otherwise be expected, viz., Oldham Road:—

11. 116 grs. of manganate = 0·0717 of $CO_2$ in the air.
12. 120 " " 0·0721 "
13. 110 " " 0·0671 "

An error of 1 grain by measurement makes a change only in the third or fourth decimal place, so that it becomes inappreciable.

Experiments 1—6 inclusive were at my laboratory, the wind blowing towards the town; from 7 to 13, at the other side of the town; the wind blowing violently, and allowing no accumulation, we may conclude that the air of Manchester is very slightly affected by carbonic acid; and certainly this condition, which is equal to a diminution of between 0·04 to 0·08 per cent. of carbonic acid, is very decidedly perceptible on the health and spirits. Violent rain tends still further to remove the acid.

This mode of looking for carbonic acid of course makes no allowance for the other acids, but gives the total acidity. The other acids may be ascertained separately and subtracted. The amount is too minute to affect the value of these experiments. The method will be valuable in deciding exactly as to the quality of offensive matter issuing from manufactures, where it

has hitherto been difficult to obtain sound chemical evidence, although the existence of even strong acid vapours could readily be detected by the senses. To separate the stronger acids from the carbonic, I purpose using carbonates for absorption, boiling off the carbonic acid. The two experiments will give the amount of each. This, however, I have not yet put into practice.

The reaction with manganate of potash requires great attention to peculiar shades of colour, and in the hands of persons the most careful, not much accustomed to it, it may not lead to exact results. I have been desirous, therefore, of finding a substance very highly coloured, and yet capable of being decomposed entirely by carbonic acid. This I have found in the rosolates of the alkalies. Rosolic acid in combination with alkalies gives an amazing depth of colour. I published lately a short memoir * explaining its formation, and showing how it might be made in abundance. In attempting to fix the colour on cloth, it was found that, however bright and beautiful it was at first, a short time completely converted it into the mere colour of the dark resin uncombined with alkali. This decomposition is effected by the carbonic acid of the air, and I am inclined to think that the method by the rosolates will meet with more general acceptance than that by the manganate—not because of greater exactness, but because of the more definite limit of the colour. As far as my present observations have gone, there is one drawback to the rosolates, and that is, the greater time needed to effect the thorough change; but this requires a little more experience.

*(To be continued.)*

A Costly Substitute for Gas.—The Lewisham District Board of Works not having been able to come to terms with the Phœnix Gas Company for lighting the district with gas, have entered into a contract with Mr. George Miller for lighting with paraffine oil, at a charge of 9s. 10d. per lamp per month, or £5. 18s. per annum. The parochial authorities of Rotherhithe tried a somewhat similar experiment a few years since, but finally abandoned it, and accepted the terms offered by the gas company.

Cuban Gas Manufacturing Company.—A letter from Havannah to a New York paper, under date Nov. 15, says:—"On the 11th instant there arrived here in the *Empire City* from New York, Mr. Charles Goodwin, engineer from the Brooklyn Gas-Works, three mechanics from the same establishment, and one from a gas-work in your city, who have all been engaged by the Cuban Gas Manufacturing Company. They have all gone to Cienfuegos, where gas-works are to be erected; they afterwards proceed to other towns in the island, so that in a year or two we may hope that every town of 15,000 or 20,000 inhabitants in this island will be lighted with gas."

Gas Controversy in Brooklyn, Long Island.—Some time ago (says the *New York Times*), a proposition of the Brooklyn Gaslight Company to supply the city with gas for another term of five or ten years was referred to the Gaslight Committee, with instructions to report thereon, and also as to the expediency of the city taking possession of the works in the manner provided, as stated above. This committee has prepared a report in favour of re-entering into contract with the old company at 2 dols. per 1000 feet for the gas used for the public lights, and not exceeding 3 dols. per 1000 feet for that consumed in private dwellings. The committee give an opinion based upon their investigations, that it would be more equal if the price of gas was 2 dols. 50 c. per 1000 to both the city and private consumers. But the gas company refuse to make such an arrangement, offering as a reason therefor that the present price is only a fair remuneration, in consideration of the large amount of mains in the sparsely-settled portions of the city "that do not pay over legal interest."

The Meter Question in America.—The *Louisville Democrat* says that a publication was made in the *Cincinnati Enquirer* of the 17th of November, by a Mr. Yates, who had been in the employ of the Cincinnati Gas Company, that the meters used by this gas company were fraudulent, and registered against the consumers. It was proved that the statements of Mr. Yates were false—that he had been discharged from the employ of the gas company because he was incompetent. The City Council of Cincinnati acted on the matter as follows:—"*Resolved*, That a special committee be appointed by council to inquire into the alleged frauds committed by the Cincinnati Gaslight and Coke Company, and practised on the consumers of gas in the city, and report to council as soon as practicable." This committee made the following report:—Mr. Perry, the chairman of the committee to whom was referred the investigation of the charge made against the gas company by one of its former *employés*, reported "that said charge was entirely without foundation. They had examined the meters, and found that the advantage was altogether in favour of the consumer." The report was accepted, and the committee discharged.

The Leicester Corn Exchange Clock.—The illumination of this clock is effected by a new method, with two large lenses placed before the burners, which are connected by a pierced tube of gas jets, so as to light one burner from the other if either should go out during the day when the gas is turned very low. A hood connected with a pipe is placed over the gas, which carries off the vapour of combustion and perfectly ventilates the dial-room. The appearance of the dial is much superior to the usual method by night as well as by day, as the illumination is evenly diffused over the dial, without glare, or the position of the burners being distinguishable in any part. The full illumination will be kept on until half-past 11, when the gas will be turned half down for the rest of the night, leaving only sufficient light to enable the time to be easily distinguished; at daylight it will be turned down a stage lower, when the flame will not be higher than is necessary to keep it from going out. These points have been ascertained by experiments, and stops placed in connexion with a tap on the ground floor, by which the gas may be turned exactly to the right place in the dark. The former clock used to be illuminated until half-past 11, when the gas was turned quite out, and the man had to ascend to the top of the building to relight it every night, yet the consumption of gas for the few hours' burning under the old system was about twice as much as the present system consumes burning day and night; the former illumination must not, however, be censured as an extravagant instance, for it is laid down as a rule under the old system that the annual expense of illumination is much greater than the interest of money on the whole outlay for the clock.

Silicates applied to Cements and Paint.—The *Moniteur* publishes a long report, addressed to the Minister of Agriculture, Commerce, and Public Works, by the commission appointed to examine the methods discovered by M. Kuhlmann, Professor of Chemistry at Lille, for hardening cements, porous stone, paint, &c., by means of soluble alkaline silicates. If silex or common flint be fused in a crucible with potash or soda, silicates of potash or soda will be obtained, which are both soluble in water. M. Kuhlmann's processes are founded on highly scientific considerations on the geological formation of rocks, the possibility of artificially producing most of the crystals of mineral substances found in nature, and the transformations which have occurred in petrified vegetable or animal remains. The applications of these principles to practical purposes are various. We call hydraulic cements such as will harden under water, and there are several such natural cements, such as Roman cement, or *puzzolane*. M. Kuhlmann gives common lime the qualities belonging to hydraulic cements by putting it in contact with a solution of silicate of potash. If 11 parts of silicate in powder be mixed with 89 of lime, a good hydraulic cement is obtained. If mortar made with rich lime be frequently watered with a solution of silicate of potash or soda it becomes hydraulic. As these facts prove the existence of a great affinity between lime and silex, M. Kuhlmann was naturally led to study the action of silicates on limestone and chalk (carbonate of lime), and discovered that the latter, treated at the common temperature with a solution of silicate of potash, was in part transformed into carbono-silicate of lime—a substance which hardens in course of time, and, being kneaded into a paste with the silicate of potash, will strongly adhere to the surfaces to which it is applied. This amounted to the discovery of a permanent mastic for repairing public monuments and making moulds. Moreover, if a lump of chalk be immersed in a solution of silicate of potash, it will absorb a large quantity of the liquid, and when afterwards exposed to the air it will become extremely hard. If this process of immersion and exposure be often repeated, the lump will be hardened to the depth of a centimètre and more. This process M. Kuhlmann calls silicatization. The chalk thus hardened will in course of time cut glass. From calcareous stones M. Kuhlmann turned his attention to porous stones, and found that they could be hardened in a similar way. The action of silicate of potash on the sulphate of lime—commonly called plaster—is much the same, but it has the inconvenience of producing sulphate of potash, which in crystallizing tends to produce fissures on the surface. To apply the principles thus established to operations on a large scale, the following is the process for silicatizing a which has undergone the ordeal:—Take a solution of silicate of potash,

* "Memoirs of the Literary and Philosophical Society of Manchester," vol. xv. p. 1.

# Price Current.

## CASTINGS, per Ton.

*Average Weight of Cast-Iron Gas-Pipes, per Yard.*

| 1¼ in. | 2 in. | 2½ in. | 3 in. | 4 in. | 5 in. | 6 in. | 7 in. | 8 in. | 9 in. | 10 in. | 12 in. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 16 | 21 | 28 | 33 | 51 | 70 | 89 | 107 | 126 | 149 | 177 | 208 lbs. |

| Retail Prices are 5 to 10 per cent. higher. | London. | Glasgow. | Newcastle. | Wales. | Yorkshire, Derbyshire, and Staffordsh. |
|---|---|---|---|---|---|
| | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. |
| Pig Iron, No. 1 | 4 10 0 | 2 14 0 | 3 0 0 | 4 0 0 | 4 5 0 |
| 1½ and 2 inches Socket-Pipes | 7 15 0 | 7 0 0 | 7 5 0 | 7 10 0 | 7 5 0 |
| 2½ and 3 „ „ | 7 5 0 | 6 15 0 | 7 0 0 | 7 5 0 | 7 0 0 |
| 4 and 5 „ „ | 7 5 0 | 6 10 0 | 6 15 0 | 7 0 0 | 6 15 0 |
| 6 in. and upwards „ | 7 0 0 | 6 5 0 | 6 5 0 | 6 15 0 | 6 5 0 |
| Retorts, 1st fusion, hot blast | 6 15 0 | ... | 6 15 0 | 7 0 0 | 6 15 0 |
| „ 2nd „ cold „ | 7 15 0 | ... | 7 0 0 | 7 5 0 | 7 0 0 |
| Tank Plates, ⅜ thick and above | 7 5 0 | 6 10 0 | 6 15 0 | 7 0 0 | 6 15 0 |

## WROUGHT-IRON TUBING,

*Subject to 40 per cent. Discount.*

| | 2 in. | 1½ in. | 1¼ in. | 1 in. | ¾ in. | ½ in. |
|---|---|---|---|---|---|---|
| | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. |
| Patent Welded Tubes, from 2 to 12 ft., perft. | 1 8 | 1 0 | 0 10 | 0 7 | 0 5 | 0 4¾ |
| „ „ „ 6 in. to 18 in., each | 3 0 | 2 0 | 1 9 | 1 3 | 1 0 | 0 9 |
| Connecting-Pieces, or Long Screws | 3 6 | 2 3 | 2 0 | 1 6 | 1 2 | 0 11 |
| Bends, Springs, and Elbows—wrought iron | 3 9 | 2 3 | 1 9 | 1 0 | 0 10 | 0 8 |
| Tees, wrought or cast | 4 0 | 2 6 | 2 0 | 1 6 | 1 1 | 0 10 |
| Crosses, wrought or cast | 4 6 | 3 0 | 2 6 | 2 0 | 1 6 | 1 2 |
| Iron Cocks | 17 6 | 9 6 | 7 6 | 4 6 | 3 3 | 2 6 |
| „ with brass plug | 28 0 | 16 0 | 13 0 | 7 0 | 5 6 | 4 6 |
| Diminishing Sockets, Caps, Plugs, and Plain Sockets [Nipples | 1 3 | 0 9 | 0 8 | 0 6 | 0 5 | 0 4 |
| Syphons, 2 quart | 1 0 | 0 8 | 0 7 | 0 5 | 0 4 | 0 3 |
| | 15 0 | 14 0 | 13 6 | 13 0 | 12 0 | — |

## COALS, per Ton.

| *Newcastle.—Unscreened.* | 6s. 3d. | *Scotch Cannel.* | 32s. 0d. |
|---|---|---|---|
| Whitwell Primrose | | Boghead, at Leith | |
| Medomsley, Eighton Moor, and Burnhope | 6 6 | Kirkness, best | 23 0 |
| Pelaw | 6 9 | Capeldrae, 1st quality | 20 0 |
| New Pelton, Peareth, South Pelaw, Washington Hutton, and South Peareth | 7 0 | „ 2nd „ | 12 6 |
| Pelton | 7 9 | Lesmahago, at Glasgow | 25 0 |
| Ramsay's Newcastle Cannel | 16 0 | „ „ Leith | 27 6 |
| | | Arniston | 22 0 |
| | | Wemyss | 20 0 |
| | | Knightswood | 18 0 |
| | | Pirnie | 15 0 |

## SUNDRIES.

| | | | |
|---|---|---|---|
| Best Newcastle Fire-bricks | per 1000 | 60s. | 0d. |
| „ „ „ clay | per ton | 12 | 0 |
| Cliff's Fire-bricks, at Wortley | per 1000 | 57 | 6 |
| Ingham's Fire-bricks, at Wortley | „ | 55 | 0 |
| Tough Cake Copper | per ton | £107 | 10s. |
| English Pig Lead | „ | 21 | 15 |
| Welch Bar Iron, in London | „ | 7 | 5 |
| Tarred Rope Yarn | per cwt. | 26s. | 0d. |
| Foreign Spelter | per ton | £23 | 0s. |
| English Block Tin | „ | 123 | 0 |
| Banca | „ | 126 | 0 |

## FREIGHTS.

| *Coastwise—Newcastle.—Per Ton.* | | *Foreign.—Per Keel.* | |
|---|---|---|---|
| Chatham & Rochester | 6s. 6d. | Boulogne and Calais | £8 to £8 5 |
| Cork | 9 3 | Barcelona | 22 0 |
| Dover | 7 0 | Bordeaux | 14 0 |
| Dublin | 10 0 | Cadiz | 15 0 |
| Exeter Quay | 9 0 | Copenhagen | — |
| Folkestone | 7 2 | Dieppe | £9 to 9 5 |
| Hastings | — | Genoa | £20 to 20 10 |
| London (Pool) | 6s. 3d. to 6 6 | Hamburg | — |
| Lowestoft & Yarmouth | 4s. 9d. to 5 0 | Havre | 10 0 |
| Lynn | 5 6 | Leghorn | 18 10 |
| Portsmouth | 7 6 | Lisbon | 15 0 |
| Plymouth | 8 6 | Rotterdam | — |
| Whitstable | 7 6 | Stettin | — |
| Weymouth | — | Trieste & Venice | £21 to 23 0 |

large surface, such as the sculptured front of the new Louvre, for example, prepared in the proportion required for soluble glass; this solution, marking 35° of the areometer of Beaumé, must be diluted with twice its volume of water in order to reduce its concentration to the proper degree. If the building be new, the solution is at once applied by means of fire-engines or similar contrivances playing upon the surface, care being taken to collect the waste liquid again by means of small gutters properly arranged. The outlay in silicate does not then exceed 75 centimes per square mètre. By varying the silicates different colours may be obtained: a double silicate of manganese and potash gives a dark tint applicable to white limestone; if artificial sulphate of barytes be added to the silicious solution, the surface of the monument may be whitened; sulphate of iron gives a rusty tint; sulphate of copper a splendid green; and sulphate of manganese a brown colour. The same processes may be applied to house painting; the oils and essences usually employed are then replaced by silicates. Oxide of zinc and artificial sulphate of barytes, mixed together, give a beautiful white. The latter substance especially is excellent. It resists sulphuretted hydrogen gas, is perfectly innocuous, and cheaper by two-thirds than other white pigments. Coloured substances liable to change under the influence of alkalies cannot be used with silicates; but all ochres, blue and green ultramarines, oxide of chromium, the yellow of zinc, sulphuret of cadmium, minium, calcined lampblack, oxide of manganese, &c., are perfectly applicable. Stone takes this kind of paint best; woods do not take it so uniformly, on account of the resins they contain; nevertheless, ash and elm form an exception. Silicatized colours applied to glass will adhere perfectly, and resist washing with warm water; if exposed to a strong heat they are transformed into a beautiful enamel. The coal used for Indian ink ground together with silicate of potash gives an indestructible writing ink. In calico-printing the silicate of potash replaces albumen, which is commonly used to fix colours with. In paper-hangings he substitutes a coating of tannin for the varnish by which the colours fixed with gelatine are usually protected; for the gelatine itself he substitutes fecula fixed by lime or barytes. As the tannate of gelatine is a kind of artificial leather, he uses it to varnish wood, paper, shaded drawings, plaster statues, &c., with. Lastly, these same substances —viz., tannate of gelatine and starch fixed by lime or barytes—may be employed for painting in distemper.

## Advertisements.


*By Her Majesty's Royal Letters Patent.*

**JOSEPH BOULTON, Patent Dry** GAS-METER MANUFACTURER, and also Maker of his Improved WATER METERS.

No. 28, BAGNIGGE-WELLS ROAD, CLERKENWELL, adjoining the Police Office.—Late of No. 1, Coppice-row, LONDON.

Experimental and Station Meters of any size made to order on the shortest notice.—Governors, Pressure Registers, Gas-cooking Stoves, and every description of Gas Apparatus.

**CAST-IRON Retorts, Socket Pipes** with Syphons and all requisite Connexions, Lamp Columns, Wrought Iron Tubing, Valves, Street Lamps, Sight Holes, Furnace Doors, Ash Pans, Charging and Coke Shovels, Iron Pails and Coke Barrows, Cross Bars, Fire Pots, Pumps, Iron Borings.

PURIFIERS, CONDENSERS, and SCRUBBERS erected complete, or the materials supplied; with every description of goods in use by Gas-Works, in stock, on wholesale prices, at

LYNCH WHITE'S,
Old Barge Iron Wharf, Upper Ground Street, LONDON.

TO GAS COMPANIES.

**J. W. GRAZEBROOK. 75, Old** BROAD STREET, LONDON,

Having applications for New and Second-hand Gas Apparatus, would be obliged by those Companies having Apparatus to dispose of, to send particulars. And Companies requiring Apparatus are solicited to apply.

PIPES, RETORTS, TANKS, GASHOLDERS, &c. on Shortest Notice.
STOURBRIDGE and NEWCASTLE FIRE GOODS.
CONTRACTS TAKEN.

**R. LAIDLAW and SON, Gas ENGINEERS,**

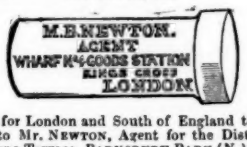
Iron and Brass-founders, and Manufacturers of Cast-Iron Retorts, Condensers, Exhausters with Engines, Scrubbers, Purifiers, Station-Meters, Cast-Iron Tanks, Gasometers, Valves, Cast-Iron Pipes, &c.

Consumers' Meters, both wet and dry, of improved construction.

Internal Gas-Fittings of every description.

ALLIANCE FOUNDRY,
EAST MILTON STREET, GLASGOW.
LONDON OFFICE:
162, STRAND, NEAR SOMERSET HOUSE.

**J. CLIFF'S Fire Bricks, Clay** RETORTS, &c.




Orders for London and South of England to be addressed to Mr. NEWTON, Agent for the District, 13, Westbourne Terrace, BARNSBURY PARK (N.).

N.B.—A few Retorts of each size, and a large stock of Bricks and Lumps, always on hand at the above Wharf.

**WROUGHT-IRON Guides for Gas-holders.**—Designs and Working Drawings for Trussed Wrought-Iron Guides and Frames can be obtained of CHARLES DIXON, C. E., Chichester, SUSSEX.

**WILLIAM RYDER, General** MINERAL AND METAL AGENT AND MERCHANT, 4, DEAN STREET, NEWCASTLE-ON-TYNE,

is prepared to supply Gas and Water Companies with Apparatus and Appliances of every description, including Cast and Wrought Iron Goods, Coals, Fire-Bricks, Retorts, &c. &c.

Any communications addressed to him as above shall have prompt attention.

**GEORGE CUTLER, Gasholder** MAKER,

No. 8, WENLOCK-ROAD, CITY-ROAD, LONDON.

Contracts for Tanks, Gasholders, Roofs, Purifiers, and all descriptions of Gas Apparatus executed on the most reasonable terms. Improved Slide Valves, Steam, and Range Boilers, and Smiths' Work, of the best materials and workmanship.

LESMAHAGO GAS COAL.

**JAMES FERGUSON and CO., Lessees** of the Auchinheath and Craignethan Gas Coal-fields (the most extensive and valuable in the parish of Lesmahago), respectfully intimate to the Managers of Gas-Works and Consumers of Gas Coal, that he is prepared to ship the best quality of the above well-known COALS at Glasgow or Leith; and also to deliver them at the railway stations upon, or connected with, the Caledonian Railway, to any extent which may be required.

Price, free on board, or delivered at the railway stations, may be learned by addressing James Ferguson and Co., Gas-Coal Works, Lesmahago.

Shipping Agent for Glasgow:
MR. ALEXANDER STRATTON,
159, WEST GEORGE STREET.

*By Royal Letters Patent.*

**KAY'S Patent Equitable Gas-Meter** is the most effective preventive of fraud by "tilting," and is as simple in construction as the common meter.

Manufactured only by
**W. COWAN,**
60, BUCCLEUCH STREET,
EDINBURGH.

**CHARLES BOTTEN and SON, ENGINEERS & METER-MAKERS,**
CRAWFORD PASSAGE, RAY STREET,
CLERKENWELL, LONDON (E. C.).

Manufacturers of Station and Patent Protector Consumers' Meters, Patent Slide-Valves, Gas-Fittings, Pipes, &c.

Also, High-pressure Cocks, Hydrants, Closets, and all Water-Fittings.

**EIGHTON MOOR GAS COALS.**—Parties wishing to be supplied with these first-class Gas Coals will please to apply to Mr. MATTHEW NESBIT, EIGHTON MOOR OFFICE, NEWCASTLE-UPON-TYNE. These coals are well known as among the richest in gas, and working the roundest on the River Tyne. They are extensively used by metropolitan gas works.

CARTER'S PATENT SAFETY GAS VALVES.

**THOMAS LAMBERT and SON,** PATENTEES AND MANUFACTURERS,
SHORT STREET, NEW CUT, BLACKFRIARS, LONDON.

The Bank of England is fitted entirely with these Valves, from the smallest branch to the largest main pipe.

The following, among numerous Testimonials, will be found very satisfactory:—

"The British Gaslight Company's Office, No. 105, Broad Street, Ratcliff, London, June 10, 1846.

"Gentlemen,—In reply to your inquiry, I have to state that 'Carter's Patent Gas Valve' has been used by this company and by the fitters of the district extensively for seven years past. It was adopted to obviate the inconvenience of setting fast, so prevalent with the conical metal plug-cocks, and has been found to answer the purpose intended.

"I have recommended its use in several provincial towns with which I am professionally connected, and have not received any complaint of its having failed in any respect of performing satisfactorily all that is required of it.—I am, Gentlemen, yours respectfully,
"GEDDIE PEARSE.

"Messrs. Lambert and Son, Lambeth."

# FIRE-CLAY RETORTS.

# JOHN SWARBRICK,

## MANUFACTURER OF PATENT COMPOSITION CLAY RETORTS,

FIRE BRICKS OF EVERY DESCRIPTION, SHAPE, AND SIZE, &c. &c.

**HIGHER EANAM, BLACKBURN, LANCASHIRE.**

These RETORTS are generally used in the Gas-works of Preston, Accrington, Bury, Heywood, Middleton, Rochdale, Ratcliffe; the Mills of Messrs. Horrocks, Miller, and Co., Preston, &c. &c., and are unequalled in having afforded general satisfaction to those who have given these Retorts a trial.

To meet the increasing demand, the Works at Little Harwood have been greatly enlarged; and Gas Engineers who may favour with an Order may rely with confidence on their being promptly supplied with an article not to be surpassed in finish or durability.

**PRICES MODERATE.**

## TO GAS COMPANIES, GAS PROPRIETORS, AND GAS ENGINEERS.

## JOHN VICKARY

begs to call the attention of the above to his improved METALLIC CASE GAS-METER, an improvement which has met with entire approbation from the various Gas Companies and Engineers to whom he has introduced it, and acknowledged to be the greatest improvement that has been made since the year 1832; at which period a metal was introduced for the construction of the Drum, Syphon, and Float, capable of resisting any impurities arising from either gas or water, which has been found to answer every expectation; as, in repair, Drums of the above date are found in perfect and good condition, when the Outer Case, Valve-box, Inlet-pipe, &c., are quite destroyed and entirely past repair.

J. V. has introduced a coating or lining of the above metal in the Outer Case, Valve-box, Inlet-pipe, &c., thereby rendering the whole as durable as the Drum, as not a particle of tin plate is exposed to the action of either water or gas; and preventing the possibility of gas passing above the water line through the front into the body of the Case to the outlet unregistered, which frequently occurs. When the Meter has been in use for any length of time it is generally found that rust or decay takes place *above* rather than under the water line, which is only discovered when they need repair. Also the Inlet-pipe and Valve-box are generally found quite decayed, which cannot happen in the above improvement.

J. V. feels confident that the above will be found a most desirable and perfect instrument, as it contains all other improvements of utility that have been introduced up to the present time.

The most strict attention is given to the workmanship as well as the registration of every Meter, to render them perfectly accurate.

Station Meters, Governors, &c., made on the shortest notice, as well as Gas Cooking Apparatus of every description, Gas Baths, &c.

Meters sent at the lowest London prices.

*Carriage paid to any part of England.*

WEST OF ENGLAND GAS METER AND GENERAL GAS APPARATUS MANUFACTORY, 84, FORE STREET, EXETER.

THE PURIFYING-HOUSE SUPERSEDED.

**MR. LAMING** (Inventor of the Revivified Oxide of Iron Purification) has the satisfaction to announce that Gas may now be purified in a manner that combines unusual commercial advantages with all the possible requirements of the sanitary officer and the public. All that need be said to call attention to the new process is, that instead of the purifying-house, two vessels of small area, placed after the condenser, suffice; that these vessels never have the least communication with the atmosphere; and that neither lime, oxide, nor any other substance foreign to the gas itself is brought into contact with it. Gas engineers will perceive among the advantages thus offered, economy in room, labour, and materials; impossibility of nuisance; and total absence of injury to the illuminating power.

Particulars by addressing RICHARD LAMING, 118, FENCHURCH STREET.

**WALTER MABON, Engineer,**
ARDWICK IRON WORKS, FAIRFIELD STREET,
MANCHESTER,
Manufacturer of
IRON TANKS for Gasholders, Railway Stations, &c.
GASHOLDERS.—Extensive premises at Gorton, solely for the manufacture of Gasholders, and other heavy Wrought-Iron Structures.
GAS APPARATUS.—W. M. has an extensive assortment of patterns for Purifiers from 4 feet to 15 feet square, also round ones from 4 feet to 10 feet diameter; Scrubbers, Condensers, Washers, Columns, Girders, and Tripod Patterns, suitable for Gasholders, from 10 feet to 150 feet diameter, either Single-lift or Telescope. Contractor for Gas Works of any Magnitude. Designs, Specifications, and Estimates furnished.
WROUGHT and CAST IRON ROOFS for Railway Stations, Gas Works, Warehouses, and Sheds, prepared for Slates or for Corrugated Iron.
IRON HOUSES, either for Dwellings, Manufactories, or Public Buildings.
PIPES and VALVES, for Gas and Water, from 2 inches to 48 inches bore.

**JOHN ROGERSON and CO.,**
NEWCASTLE-ON-TYNE & MIDDLESBRO'-ON-TEES.
Wrought and Cast Iron Pipes, Cast-Iron Retorts, and all kinds of Foundry Work necessary for Gas-Works. Fire-Bricks and Clay Retorts. Gas Coals of every description. Pig, Bar, and Plate Iron.

**BRYAN DONKIN and CO.'s improved** GAS VALVES have been adopted by numerous Gas Companies in England and abroad, and their advantages and great security fully proved. Very large numbers are in use. Prices from 11s. 6d. to 13s. 6d. per inch diameter.
BRYAN DONKIN and Co.,
Engineers, near Grange Road, BERMONDSEY.

**BIRTLEY IRON WORKS,**
CHESTER-LE-STREET,
DURHAM.
Manufactory for every description of Casting and Machinery for Gas Works and Water Works.
Warehouse in London for Cast-iron Pipes and Connections of all sizes and in any quantity, Scott's Wharf, Bankside, Southwark.
Office in London, Mr. E. M. PERKINS, 78, Lombard Street.

**WEST and GREGSON, Gas-Meter** MANUFACTURERS, &c.
UNION STREET, OLDHAM.
Station and Experimental Meters, Gas Pressure Registers, Gauges, Experimental Gasholders, Governors, Slide Valves, &c. &c.
W. and G. would respectfully call the attention of Gas Engineers and Managers to their Station-meters, having made and erected the largest in use at the present time, two of which may be seen at the Stockport and Liverpool Gas Works, on application to the respective Engineers.

**GEORGE ANDERSON,** Gas and CONSULTING ENGINEER,
104, LEADENHALL STREET, LONDON (E.C.).
DIRECT-ACTING GAS-EXHAUSTERS,
supplied either with or without Steam-Engines and Boilers.
FOUR-WAY DIAPHRAGM VALVES,
one of which answers the purpose of THREE ordinary Valves, as applied to Purifiers, or in shutting off and passing Station-Meters, Governors, or other apparatus, while the Connecting-Pipes are also much simplified.
RETORT SETTINGS,
designed to be heated by Tar alone, and with a total absence of Smoke.
Illustrated circulars, giving references and every information, may be obtained on application as above.

GAS-WORKS ERECTED, ALTERED, VALUED, OR LEASED, BY
**GEORGE WALCOTT,** Gas and CONSULTING ENGINEER,
BEAUMARIS GAS-WORKS, ANGLESEA,
who has erected twenty Gas-Works during the last four years, all of which are giving satisfaction.
London Office, 24, Abchurch Lane, CITY.

**ALFRED PENNY,** Engineer,
WENLOCK IRON WORKS,
WHARF ROAD, CITY ROAD, LONDON.
Mr. PENNY begs to inform Gas and Water Companies that he undertakes the erection of new, or the alteration of existing, works; and that he may be consulted generally on all matters connected with gas and water supply. He is also prepared to supply best Cold-blast Retorts, Socket-Pipes, and Connections, Iron Borings, &c. &c., and all the necessary Castings used in Gas and Water-Works.
*** Country orders executed with care and despatch.

*By Her Majesty's Royal Letters Patent.*

# JAMES MEACOCK,

## PATENT DRY and IMPROVED WET GAS-METER WORKS,

7, SNOW HILL, AND 16, WEST STREET, LONDON.

ESTABLISHED 1836.

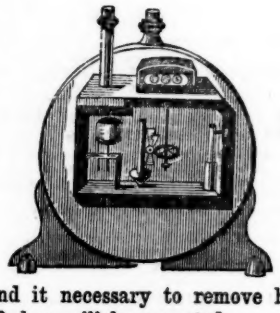
J. MEACOCK begs to call attention to his patent method of securing the Leather diaphragm of his Dry Meter. Instead of using the soldering iron for this purpose, it is held between two flat Metal Rings, and screwed up sound to a metal frame, as shown in the drawing.

By this improvement the perishing effect of hot tools to leather being avoided, its durability must be longer; also, its repair when needful is most simple, as a new leather diaphragm can be applied by merely unscrewing the old one from the rim or frame to which it had been screwed up.

Meters of Gas Companies being subject to so much wear and tear, J. M. begs leave to assure those who may honour him with their commands, that nothing but the stoutest materials for cases, the hardest gas-resisting metals, and best foreign leather for the interiors, will be used, and none but first-class workmen employed in their construction.

Wet Gas-Meters Repaired and Reconstructed with J. Meacock's Modern Improvements.

METERS SENT ON APPROVAL.



**In consequence of the great demand for the above Meters, J. Meacock has found it necessary to remove his Manufactory to more extensive Premises, 16, West Street, Smithfield, where Orders will be executed on the shortest notice.**

**ADDISON POTTER,**
WILLINGTON QUAY,
NEAR NEWCASTLE-UPON-TYNE,
Manufacturer of Clay Retorts, Fire Bricks, and every description of Fire Clay Goods.

**WHITEHOUSE and CO., Boiler and GASHOLDER MAKERS,**
GLOBE PATENT TUBE WORKS,
WEDNESBURY,
Beg to draw the attention of Engineers and Managers of Gas Works to the superior quality of the Article they manufacture, both in respect of the iron employed, and the perfect manner in which it is welded; in proof of which they can refer to the testimonials of the most eminent Gas Engineers, and the experience of the principal of the large Gas Companies of the kingdom.
Orders promptly executed.

NOW READY,
**VOL. VI. of the JOURNAL of GAS** LIGHTING, WATER SUPPLY, and SANITARY IMPROVEMENT, for 1857, price 21s., bound in cloth and lettered. A few copies of Vols. II., III., IV., and V. are still on sale.
W. B. KING, 11, Bolt Court, Fleet Street.

**M. SHEEN, Gas and Railway** Lantern Maker, 90½, Holborn Hill, begs to inform Managers of Gas-Works, &c., that she continues to contract and supply Lanterns on reasonable terms, and keep them in repair by the year.

**PADDON and FORD** respectfully invite the attention of Gas Companies and Managers to their PATENT STREET LAMP REGULATOR, which ensures any required consumption.
By its use a great saving is effected, and the item of "Unaccounted-for Gas" considerably decreased.

**PADDON and FORD,** Patent GAS-METER AND APPARATUS WORKS,
GRAY'S-INN-ROAD, LONDON,
Manufacturers of WET and DRY GAS METERS, STATION METERS, GOVERNORS, EXPERIMENTAL APPARATUS, LANTERNS, &c. &c.
Contractors for the erection or alteration of Gas-Works; and every description of Apparatus required in Gas-Works supplied.

TO THE GAS COMPANIES
OF GREAT BRITAIN AND THE CONTINENT.
**CANNEL AND COAL FOR GAS** PURPOSES.—Fifteen years' connexion with one of the largest Gas Concerns in England, enables us from practical experience to certify that the CANNEL and COAL we offer are those best suited for Gas purposes.
On application, we shall have much pleasure in forwarding our Tabulated Statements of Analyses, with Prices and Terms; also References as to respectability.
All Contract Orders have our careful and best attention.
EMANUEL TURNER and Co., Exporters of Cannel and Coal, 34, Castle Street, LIVERPOOL.

**HARRIS and PEARSON,**
PROPRIETORS OF
BEST GLASS-HOUSE POT AND CRUCIBLE CLAY.
MANUFACTURERS OF
FIRE BRICKS GAS RETORTS &C.
AMBLECOTE FIRE CLAY AND BRICK WORKS,
STOURBRIDGE.
*Late in the occupation of I. and W. King. Originally J. Pidcock, Esq.*

**BENJAMIN GIBBONS, Jun.,**
DEEPDALE FIRE-CLAY & BRICK WORKS
Near DUDLEY,
Manufacturer of every description of Fire-Bricks, Lumps, Quarries, Shields, Flue Covers, &c., to any size or shape required.
FIRE-CLAY RETORTS,
TO MODEL OR DRAWING.
B. G. begs to call the attention of Gas Companies to his Fire-Clay Retorts, which have been used with great satisfaction in some of the largest Gas-Works in the Metropolis and many Provincial Towns in England.
References given, if required.

CEMENT.
**G. and T. EARLE, Hull, beg to draw** the attention of Gas and Water Companies, Engineers, and Contractors, to their Light Cement, for Stuccoing and Building Gasholder Tanks, and Jointing Iron Pipes, for which purposes it will be found a very superior article.

# FIRE-CLAY GAS RETORTS.

ESTABLISHED IN 1795.

## JOSEPH CLIFF,

**WORTLEY FIRE-BRICK WORKS, near LEEDS.**

THESE RETORTS are unrivalled in excellence, being the BEST FINISHED INTERNALLY, and THE MOST CORRECT IN FORM, of any in the Kingdom. From the peculiar composition used in working up the face of the material, they are rendered unusually smooth, close, and FREE FROM SURFACE CRACKS, thus, in a great measure, preventing leakage and the adhesion of carbon to their interior surface.

To meet the yearly increasing demand of UPWARDS OF THIRTY SEASONS and to carry out the late improvements in the manufacture, the Premises have been re-erected and much enlarged, and Engineers may rely WITH CONFIDENCE on their orders being completed with a greater regard to despatch than by any other House.

THE WORKS ARE WELL SITUATED

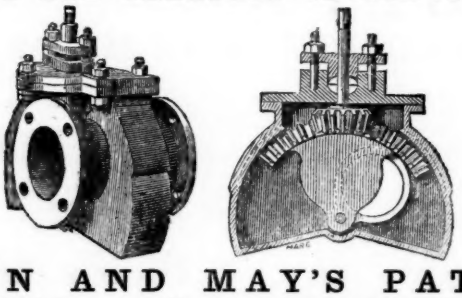
For EXPORT from the Ports of { LONDON, LIVERPOOL, HULL, MIDDLESBRO', HARTLEPOOL, and STOCKTON.

FIRE-BRICKS, LUMPS, GUARDS, TILES, AND CLAY OF THE SAME QUALITY.

**M. B. NEWTON, London Agent, No. 4, Wharf, King's Cross Goods Station.**

---

**BEST AND CHEAPEST SLUICE-COCK.**



## BROWN AND MAY'S PATENT.

Above 3-inch diameter, price 10s. per inch. Brass face, 6d. per inch extra.

**Can be taken to pieces without being removed from the line of Piping.**

**NORTH WILTS FOUNDRY, DEVIZES.**

**Wholesale Agents, Messrs. S. and E. RANSOME, 31, Essex Street, Strand, E.C., Where a Sample may be seen.**

---

## WILLIAM PARKINSON AND CO.,

*(Successors to the late Samuel Crosley,)*

**COTTAGE LANE, CITY ROAD, LONDON,**

Beg to announce that, in addition to the manufacture of GAS-METERS, they continue the manufacture of METERS for MEASURING WATER, SPIRITS, &c., commenced, under Patent in 1849, by the late Mr. William Parkinson.

These Meters are as simple and durable as the Gas-Meter, and as correct as that instrument in the registration of the fluids passing through them.

---

**JOHN BENT, Manufacturer of** GAS-METERS, 283, BELL BARN ROAD, BIRMINGHAM, (Established 1830),

Begs respectfully to call the attention of Gas Companies, Engineers, &c., to his WET GAS METER, made upon the most improved principles, the most admirable materials, and warranted to register correctly.

---

**"ALL DOUBTS REMOVED."**

**DEFRIES' celebrated Dry Gas-METERS**, of which there are 80,000 in use in Palaces, Churches, Chapels, Royal Dock-yards, Club Houses, Public Offices, and other buildings throughout the Empire, the Continent, and Colonies.

His meter for 1500 lights, in use upwards of ten years at the Royal Italian Opera, until that building was destroyed by fire, was long afterwards dug out of the burnt ruins, then tested by the Chartered Gas Company and found inflexibly correct.

On the 9th of June, 1858, at the Western Gas Company, his meter for 150 lights, after considerable use, was doubted, and subjected to the most variable tests, from the full lighting down to a single jet, and in each case, as in numerous other instances, accuracy was finely indicated.

His two large meters at the Thames Tunnel have been in constant use day and night for upwards of twelve years (one continuation of dark hours), subjected to the wear and tear of 75 years, as compared with the ordinary hours of using gaslight above ground.

Gas Companies honouring Mr. Defries with their commands for his PATENT DRY METER, which has done so much service in simplifying the fitting up of gas, as well as checking surreptitious burning, will be guaranteed perfection for five years free of charge.

Defries' Prize-Medal Gas Baths, Gas-Cooking and Heating Stoves. The Polytechnic Gas Fire, with indestructible fuel, in daily operation (Saturday excepted) at the Office, 406, Euston Road, Fitzroy Square, LONDON.

---

# LIVESEY FIRE-CLAY WORKS,

**NEAR BLACKBURN, LANCASHIRE.**

## ORLANDO BROTHERS,

**MANUFACTURER OF PATENT CLAY RETORTS,**

AND EVERY DESCRIPTION OF

**TUBULAR GLAZED SEWERAGE PIPES, BENDS, JUNCTIONS ETC.**

**FIRE-BRICKS, TILES, BLOCKS, AND CHIMNEY-TOPS.**

---

# WILLIAM INGHAM AND SONS,

**WORTLEY FIRE-BRICK AND RETORT WORKS,**

**Near**

**Leeds.**

W. INGHAM and SONS, having for many years been extensively engaged in the Manufacture of

**RETORTS AND FIRE-BRICKS FROM THE CELEBRATED WORTLEY FIRE-CLAY,**

beg to call especial attention to their RETORTS, which have for many seasons proved to be unsurpassed in quality by any in the Kingdom, their FREEDOM FROM CRACKS and the ADHESION OF CARBON rendering them worthy the attention of all parties interested in the making of Gas.

The Works are of such magnitude as to ensure the prompt execution of orders to any extent.

**Estimates for Setting, or Bricklayers sent when required.**

**GAS OVENS IN SEGMENTS OF EQUAL QUALITY.**

**London Agents: CHADWICK and AKEROYD, Willington Stone Wharf, Regent's Park Basin.**

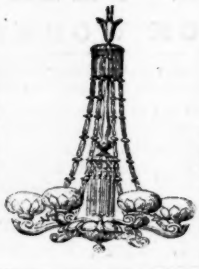
**A large stock of Fire-Bricks, Fire-Clay, Terra Cotta, and Drain-Pipes of all sizes kept in London at CHRISTIE & CO.—Wharf, 64, Bankside, Southwark, where all particulars of Prices, &c., may be obtained.**

N.B.—*Export orders continue to have prompt attention.*

# ALEXANDER WRIGHT,

GAS ENGINEER, MANUFACTURER OF GAS-METERS, GOVERNORS, AND EVERY DESCRIPTION OF GAS APPARATUS,
**55, MILLBANK STREET, WESTMINSTER.**
CONSUMERS' METERS at the List Price, with a Liberal Discount to Wholesale Purchasers.
THOMPSON'S BROMINE TEST, £1. 1s.—BROMINE, 3s. per Ounce.
BISULPHURET OF CARBON TEST, £2. 2s.
APPARATUS FOR DETERMINING THE HEATING POWER OF SAMPLES OF COAL AND OTHER DESCRIPTIONS OF FUEL, £5. 5s.,
INVENTED BY LEWIS THOMPSON, ESQ., M.R.C.S.
REGISTERING PRESSURE GAUGE, Net Price, £8. Glass Shade, 10s. extra.
STATION METERS, PRESSURE GAUGES, PHOTOMETERS, SPECIFIC GRAVITY APPARATUS, &C.

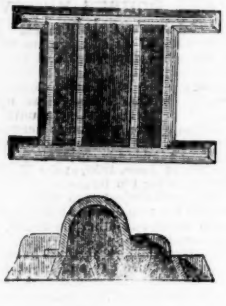
**JAMES OAKES and CO.,**
ALFRETON IRON WORKS, DERBYSHIRE,
AND
WENLOCK IRON WHARF, 20, WHARF ROAD, CITY ROAD, LONDON,
Beg to inform Gas and Water Companies and the public, that they keep in stock in London all the CASTINGS in general use in Gas and Water Works, including best cold-blast Iron Retorts, Socket and Flange Pipes of all sizes, Bends, Branches, Syphons, Lamp Columns of various patterns, &c.
N.B.—Orders for Cast-iron Tanks, Girders, Columns, Cylinders, and all irregular castings, will have immediate attention.
CHARLES HORSLEY, Agent.
C. H. is prepared to carry out the warming and ventilation of public buildings, &c.; also civil engineering in general.

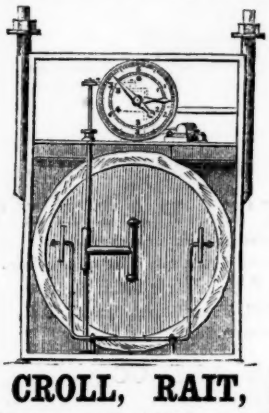


**F. & C. OSLER,**
44, OXFORD STREET, LONDON;
*Manufactory—Broad Street, Birmingham—Established* 1807,
MANUFACTURERS OF GLASS CHANDELIERS, GLASS LUSTRES, TABLE GLASS, &c. &c.
ELEGANT CRYSTAL GLASS CHANDELIERS, for GAS, from £4 upwards (Made from "REGISTERED" DESIGNS), with GLASS BRANCHES, &c.; suitable for DRAWING-ROOMS and BALL-ROOMS. The more extensive use of Gas in private dwellings has induced Messrs. OSLER to direct their particular attention to the manufacture of this class of articles—which, with a view to their general adoption, are offered at very moderate prices. Purchasers can select from a great variety of patterns, to which additions are being constantly made.
THEATRES, CONCERT, ASSEMBLY, AND BALL ROOMS LIGHTED BY ESTIMATE ON THE LOWEST TERMS.

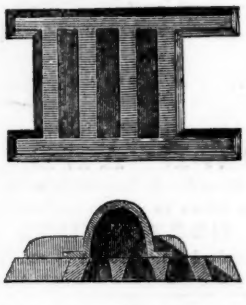
# CROLL'S
## PATENT IMPROVED DRY GAS-METER,

NEW VALVE.





OLD VALVE.



## Manufactured by CROLL, RAIT, and CO., LONDON.

**FACTORY—Blundell Street, near the Railway Station, Caledonian Road, N.**
**OFFICES—10, Coleman Street, City, E C.**

Messrs. CROLL, RAIT, and Co. beg to call the attention of Gas Companies to their Improvements in Dry Gas-Meters, which secure a steady light under all circumstances.

In forming the Valve-Seat of the Dry Gas-Meter it has hitherto been usual for the Bars to be equal in width to the openings; but, by the extent of the surfaces thus brought into contact with the Valve or Cover, it is found that fluid accumulates, and, during part of the motion of the Valve, partially closes the passage, thereby causing an oscillation in the lights.

An Improvement in the Manufacture now introduced and patented by Mr. CROLL consists of very considerably reducing the width of the Surfaces or Bars, as in the drawing of the New Valve, retaining only such width of bar as is necessary to secure correct measurement.

Another Improvement consists in the mode used of mixing and amalgamating the various proportions of Metals for the Valve, always taking care that the Valve-Seat shall be of an alloy considerably different to that of the Valve-Cover, by which the friction of the surfaces is materially lessened.

These Improvements remove at onee any liability to unsteadiness of light, and at the same time secure (from the Valve working more evenly) a greater certainty of accurate registration.

## D. HULETT and CO., 55 and 56, HIGH HOLBORN, LONDON,

**PATENTEES and MANUFACTURERS of the ONLY GOOD MERCURIAL GAS REGULATOR,**
invite the attention of Gas Companies and the Trade generally to their Improved GAS-METERS, which they warrant equal to any in Quality, Workmanship, and Simplicity of Construction, and the only Meters from which Gas cannot be obtained without being duly registered.

MANUFACTURERS OF
**GAS CHANDELIERS, GLASS LUSTRES, HALL LANTERNS, VESTIBULES, BRACKETS, PENDANTS;**
DOUBLE CONE, ALBERT, SHADOWLESS, & EVERY DESCRIPTION OF BURNER, UNION JETS, BATSWINGS, ETC.
**IMPROVED FULL-WAY CARTER'S VALVES (much approved of);**
GAS-STOVES, and every article connected with Gas Apparatus.
CAST & WROUGHT-IRON PIPE, BLACK & GALVANIZED. COPPER, TIN, BRASS, & COMPOSITION TUBING.
**D. HULETT'S IMPROVED SERVICE CLEANSER**
for clearing out Mains, Services, and Interior Fittings—60s. net.
*Boyle's Patent Silvered Glass Combination Reflectors and Outside Lanterns.*
**Sole Manufacturers of Church and Mann's Photometer.**
Large Pattern Books, with every description of Gas-Fittings, Chandeliers, &c., with complete Book of Prices, 12s.


London: Printed by WILLIAM BOTHAM KING (at the office of Joseph Clayton, 17, Bouverie Street, Fleet Street); and published by him at No. 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, January 4, 1859.